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BRITISH
MANUFACTURING INDUSTRIES

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HE INDUSTRIAL CLASSES.

AND

INDUSTRIAL STATISTICS.

BY

G. PHILLIPS BEVAN, F.S.S.

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MINING, METALS, CHEMICALS, CERAMICS, GLASS, AND PAPER.

WITH MAPS.

LONDON:
EDWARD STANFORD, 55, CHARING CROSS, S.W.

1876.

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INTRODUCTION.

To the series of volumes which bear the title of the 'British Manufacturing Industries,' I have thought that a pendant might with great propriety be added, dealing with that large section of our population employed in those manufactures. Hitherto we have been engaged with the nature of the *work* done; it is now proposed to take up the subject of the *worker*. It is singular, even in these days of social science, to note how scanty and scattered is all information about the British workman. There are no books in detail that are devoted to him, his concerns and interests being principally to be gathered from Blue Books, Reports, Transactions of Societies, and the public newspapers. From a political point of view, he has been frequently written and talked about—too much so indeed for his own good or for the good of the country,—but comparatively seldom, when we come to inquire into his social condition, as dependent upon, or connected with, his special branch of labour.

Together with the many changes in the methods of manufacture, there have been equal revolutions in the style and character of our artisans. Many new trades and processes have been introduced which were unknown thirty years ago, while, on the other hand,

manufactures which were then of the highest importance, have dwindled down, and are now in a way to become extinct. Few people are aware of the immense development of the last quarter of a century in the condition for the better of our English operatives, whether in a monetary, social, educational, sanitary, or legislative light; it is very doubtful whether the bulk of the working classes themselves ever take heed of the strides that they have made, or think how little they have to lament that the "good old times" are past and gone.

I have endeavoured in these two volumes to discuss this branch of our manufacturing industries, though, from my limited space, very briefly. It has been my aim to show how steadily progressive has been the legislation for the protection of life and health, and how our Factory and other working-class Acts have grown up, as the result of much experience and constant watchfulness on the part of successive governments. I have carefully avoided the political side of the question throughout, feeling the uselessness of discussing points, about which such grave differences exist. I may, however, be permitted to express an opinion, that it would be better for the English artisan himself, if he attended more to his own self-improvement, than to the constant agitation which is too often based upon, and the result of, insufficient and one-sided information. The educational phase too has been omitted, both from want of space, and because it has been made the subject of innumerable documents and reports elsewhere.

As regarding the statistics of population and employés, in the main, the Census tables and the Factory Returns of 1871 have been followed, as being the latest official statements on these matters which have appeared. I have frequently, however, been enabled to supplement them by later returns from various sources, or from private inquiries. The question of wages is always a difficult one, about which to gain accurate information. The Factory Returns of 1871 contain a large amount of matter on this head, of which use has been freely made, and, when possible, statements of wages at the present time have been placed side by side. In most cases the fullest information has been afforded to me, while, in a few, my request has been declined or unanswered. Anyhow, the general reader, for whom these volumes are intended, will have sufficient data to show him the ordinary earnings of our British working classes, and can therefore draw his own conclusions as to their domestic social condition.

In dealing with the statistics of each trade, more figures have possibly been introduced than may be agreeable to my readers, but I have done so in the hope of showing, how intimately allied is the development of our manufactures with the state of wages and the general condition of the working classes, and of making this branch of my subject rather a text upon which to found my discourse, than as the main feature of the work.

In conclusion, I have to acknowledge the very courteous and kindly assistance which has been

afforded to me by a great number of correspondents, official and otherwise, the majority of whom, although immersed in business themselves, have yet found time to procure me the knowledge which I have sought. I have freely borrowed, wherever any information was to be gained, although in all cases the source from which it was obtained has been acknowledged. Where so many facts and figures are involved, there must needs be errors or omissions; and for any corrections or additions I shall be greatly obliged.

G. PHILLIPS BEVAN.

BRITISH MANUFACTURING INDUSTRIES.

CHAPTER I.

MINING INDUSTRIES.

I. Coal Mining.

In commencing an account, statistical or otherwise, of the working classes, our mining interests claim the first place, partly because our mineral treasures furnish the base of all our manufacturing prosperity, and partly because colliers and miners form such a large section numerically of British operatives. A glance at the accompanying map will show the districts of Great Britain in which coal getting is the staple trade; and I shall first deal with the collier, as the term "mining" is usually applied to the raising of ore, rather than of coal.

From the Census tables of 1871 (which throughout the whole of my subject must be the groundwork of the population returns) it appears that, at that date, there were in England and Wales 268,091 males and 3251 females employed in coal getting. Of the former, 74,608 were under twenty, and 193,483 above that age; of the latter, 1511 were under twenty, and 1741 above

that age. The following were the respective ages of this class of operatives:

	5–	10–	15–	20–	25–
Males	219	27,502	46,887	42,928	63,707
Females ..	3	276	1,232	731	459

	35–	45–	55–	65–	75
Males	42,818	25,589	12,637	4,733	1,071
Females ..	231	153	104	56	6

In addition, however, to the actual coal miners, the Census authorities have added those engaged in coal-mine service, viz. males 10,346, which brings up the English coal workers to 281,688. In Scotland the numbers amounted to 47,265, and in Ireland to 671, making the total of British coal miners 329,624. If we turn, however, to the Mines Inspectors' Reports for 1875,* we find a different result, which, at first sight, seems to be at variance with that of the Census. The number of coal workers given in this Report was:

Underground	427,017
Above ground	108,282
Total	535,299

But under the Coal Mines Regulation Act are included those working in mines of ironstone, fireclay, and oil-shale, whereas the Census gives iron miners under a dis-

* 'Coal Mines Inspectors' Reports,' 1875.

tinct heading. In districts where iron mining is carried on as a distinct operation, such as in Cleveland, it is easy to make a population return of that branch of trade; but it must be remembered, that in nearly all the coal fields, the argillaceous ores are so mixed up with the coal seams, that they are worked out of the same mine, and it becomes a great difficulty to separate those who raise the "mine" from those who raise the coal. I should say, that in round numbers we might put the colliers proper at 150,000. or thereabouts. From the same Reports we learn that there were 4445 collieries, in which this large body found employment; and the table on the next page will show the Inspectors' districts, and the approximate number of operatives in each.

Considering that at least half a million of our population is engaged in this one occupation, it is surprising how little is known of it by the outside world. One reason of this is, that the geological features of our coal basins differ so much in detail, though not in their broad features, that it has caused corresponding differences in the style of working, the nomenclature of the various seams, and even the habits and language of the colliers. In the same coal fields indeed, although certain main seams are recognized throughout the district, they are not always under the same name; and, where local alterations occur, as is frequently the case, a considerable amount of confusion, often leading to trouble and expense, is caused. Comparing one basin with another, we find still broader divergences. Seams of coal, fireclay, rubbish, parting, rock, and all the many beds that go to make up a

	No. of Mines.	Under-ground.	Above ground.	Total.	Female.
I. NEWCASTLE DISTRICT—					
Northumberland	216	20,663	4,691	25,354	5
North Durham (north of the Wear)		14,100	3,808	18,208	6
Cumberland		4,763	1,735	6,498	343
II. DURHAM DISTRICT—					
South Durham (south of the Wear)	214	46,850	11,726	58,576	7
Westmoreland		18	1	19	
Yorkshire (North Riding)		Not included here, as it is all Cleveland Ironstone.			
III. MANCHESTER DISTRICT—					
Lancashire (North and East)	373	27,305	5,701	33,006	142
Ireland	43	1,069	475	1,554	6
IV. LIVERPOOL DISTRICT—					
Anglesea	313	15	7	22	
Denbighshire		6,479	1,683	8,162	106
Flintshire		1,266	1,208	2,474	
West Lancashire		24,314	7,244	31,558	1,418
V. YORKSHIRE DISTRICT—					
Yorkshire (West Riding)	520	49,006	13,184	62,190	40
VI. MIDLAND DISTRICT—					
Derbyshire	422	23,683	6,414	30,097	
Leicestershire		3,983	1,080	5,063	
Nottinghamshire		9,618	3,095	12,713	
Warwickshire		3,505	1,099	4,604	
VII. N. STAFFORDSHIRE DISTRICT—					
Cheshire	250	2,039	695	2,744	
Shropshire		5,513	2,204	7,717	1,142
North Staffordshire		14,908	4,687	19,595	
VIII. S. STAFFORDSHIRE DISTRICT—					
Worcestershire	573	26,457	9,211	35,668	1,433
South Staffordshire					
IX. SOUTH WESTERN DISTRICT—					
Breconshire (part)	408	655	110	765	110
Glamorganshire (part)		2,178	451	2,629	
Forest of Dean		3,803	891	4,694	
Bristol		2,782	675	3,457	
Monmouthshire		15,133	2,868	18,001	
Somersetshire		3,674	916	4,590	
X. SOUTH WALES DISTRICT—					
Breconshire (part)	362				
Carmarthenshire		42,764	8,484	51,248	796
Glamorganshire (part)					
Pembrokeshire					
XI. EAST SCOTLAND*	379	34,255	7,059	41,314	44
XII. WEST SCOTLAND	..	25,171	5,177	30,348	

* Both East and West Scotland include argillaceous ores, fireclay, and sha[le]

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Stanford's Geog.l Estab.t London

section, have been named according to the fancy of the neighbourhood, or any appearances which may have struck the workmen; so that if the local vocabularies of British colliers could be collected, there would be found numbers of words meaning the same thing. Nor is the difference confined to dialect or idiom. Our collieries being scattered over so many distant parts of the kingdom, there are necessarily impressed upon the workers differences of race and locality; and, moreover, the geological features vary so much, that it involves distinct styles of labour, which, to some extent, influence the physique of the labourer. If we compare, for instance, the magnificent Thick, or 30-feet, seam of South Staffordshire, with the miserable ones of Ireland, many of them not more than 8 inches, it will be seen what a different class of collier the two workings would require.

The ordinary visitor to a coalpit is naturally apt to think very strongly of the miserable condition of those who are obliged to work underground; and certainly the appearance of a pit-shaft and its surroundings is not inviting, except to those connected with the trade. But there is no reason why colliers should be pitied for being obliged to work in the bowels of the earth, for, as a rule, they not only get speedily accustomed to it, but prefer it to occupation above ground. One reason is, the good rate of wage that ordinarily obtains in coal getting; another, that the temperature of a well-managed mine is pleasant and agreeable, being never too hot in summer or too cold in winter, while the discomfort of spending so much of one's life in the

dark is more fancied than real. As an occupation, coal mining cannot be said to be unhealthy. Colliers frequently live to a good old age, and do not suffer from any specific maladies, except where there is a tendency to lung disease. In extreme cases of this, the lung becomes so charged with carbon in the form of fine powder, as to present the appearance of being carbonized. In the Factory Reports for 1872, there is an engraving of this kind of lung ("collier's phthisis"), taken from the chest of a man sixty-five years of age, who had worked in a coal mine from boyhood till within two years of his death. But even this case speaks well for a trade, which could be followed without intermission for over fifty-five years.

The following is a table of the deaths of coal miners (males) in 1871. Total deaths, 3982; viz. 405 under twenty, and 3577 above twenty:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
1	96	20	455	655	551	525	571	522	318

These figures do not show undue waste of life at any particular age, but rather a tendency to living on. Where the rapid mortality of colliers is chiefly seen, is in the lamentable number of accidents, the chief medium, unfortunately, by which the newspaper reader makes his acquaintance with this class of workmen. The Inspectors' Reports for 1875 show that in that year, 1244 lost their lives; and that for every 118,730 tons of coal raised, one life was sacrificed. The relative proportion of deaths per ton since 1868 is:

Year.	Tons raised.	Deaths.	Proportion to Tons.
1868	104,566,959	1,011	103,429
1869	108,003,482	1,116	96,777
1870	112,875,525	991	113,900
1871	117,439,251	1,075	109,246
1872	123,393,853	1,060	116,409
1873	128,544,400	1,069	129,843
1874	126,214,368	1,056	119,521
1875	133,306,485	1,224	108,918

The great bulk of colliery accidents arise from explosions of firedamp and its no less deadly concomitant, chokedamp, falls of roof and sides, casualties in shafts and above ground, though generally explosions carry off a large percentage. The table of deaths for 1875 shows the various forms in which they happened:

Underground.

Explosions	288
Falls of side	127
„ roof	331
Explosions (powder)	22
Suffocation by gas	32
Irruptions of water	8
Overwinding	4
Ropes and chains breaking	6
Ascending or descending	41
Falling from surface into shaft ..	18
Things falling from surface	13
Falling part way down into shaft ..	33
Things falling part way down ..	23
Sundries in shafts	34
Inclined planes	38
Trams and tubs	88
Machinery	9
Sundries underground	30

	Above ground.
Machinery	16
Boilers bursting	3
Sundries	80

We are painfully familiar with catastrophes, such as those of Lundhill, Ferndale, Hartley Main, Cymmer, The Oaks, and scores of others, which have every now and again harrowed the feelings of the whole country. If all the violent deaths were summed up, which have occurred since the first published Report in 1851, we should be startled to find how many thousands of our fellow-creatures had perished, while peacefully following their occupation. Modern science and invention have unceasingly, and, to a great extent, successfully laboured to rob coal mining of its dangers; and in the essay on Coal mining which forms part of this series,* Professor Smyth has given a *résumé* of these improvements, and shown us what great benefits have been conferred on colliers by the safety lamps of Davy, Clanny, Stephenson, and Mueseler; by Struve's ventilators and Guibal's fans; by the safety cages of White and Grant, Owen and Calow, and the many other ingenious arrangements by which the risk by accident has been so much lessened.†

The Legislature too has done its part worthily, in endeavouring to make coal mining as safe as it can be made; but there is unfortunately an element which no law-making can reach and no invention guard against, viz. the recklessness and temerity of the men

* 'British Manufacturing Industries.'

† Of the coal-cutting machine, and its probable influence on the collier, it is too early at present to speak.

themselves. As long as it is *possible* for a collier to evade the regulations of the mine and blow himself and his fellows into eternity, so long will the death roll be a large one. Even under the most favourable circumstances, and when a pit is ventilated in the most approved fashion, it has happened that a single stroke of the "pick" has given vent to a "blower" of pent-up gas, which has in a moment overpowered the ventilating apparatus and fired the whole mine. But these instances are not common; and it will generally be found that nine-tenths of explosions may be traced to some infraction of the rules by a workman trying to obtain a little more light, or the stealthy delight of a pipe. As long as coalpits exist, and colliers are what they are, so long will there be danger from this source.

Legislation for coal mines dates from 1851, previous to which, an inquiry had been instituted by the Government into the cause of explosions, and a very interesting report issued, containing the opinions and experiences of the leading viewers and chemists of the day. A similar inquiry had, before this, been made into the social condition of those engaged in coal mines, which resulted in the passing of the Regulation of Mines and Collieries Act, 1842 (5 & 6 Vic. c. 99), which prohibited the employment of females, as also boys under ten, underground. The system of inspection dates from this time; and various rules were laid down for the better safety of the colliers. The state of things revealed in the inquiry showed how low was the social status of the women, who had up to this time been allowed to work underground, while young

children grew up in semi-barbarism; and it was high time that this great evil should be taken in hand. Of late years the employment of women in the coal-mine service, such as at the pit bank and the screens, has been diminishing, and although there is nothing indecorous or degrading in the work, public opinion seems to be gradually setting itself against the custom, as being an occupation which is not suitable for women. At present there are between 7000 and 8000 engaged in it.

Another Act was passed in 1855 (18 & 19 Vic. c. 108), in which the duties of the inspectors were more accurately defined, and increased protection given to the workmen in the shape of better ventilation, fencing of shafts, improved signalling, &c. In 1862 came the Collieries Amendment Act (25 & 26 Vic. c. 79), which compelled every colliery owner to provide two distinct means of egress from his coal seams, such outlet to be separated by not less than 10 feet of strata. Owners were allowed reasonable time to make this important alteration, and the Act provided for inquiry and arbitration, in cases where unusual difficulties existed. That such a regulation was needed, was shown by the Hartley Main accident in January 1862, when 204 lost their lives in consequence of not being able to leave the pit, through the breaking of an iron beam. The Coal Mines Regulation Act of 1872 was the latest and most comprehensive, the principal points being as follows: *Underground*—Women and girls not to be employed at all; neither boys under twelve years, except where the mine is

exempted by the Secretary of State by reason of the thinness of the seams. Boys under thirteen and male young persons under sixteen may be employed not more than fifty-four hours a week, or more than ten hours a day, and must be allowed an interval of twelve hours for rest between each two consecutive periods of employment. *Above ground*—No children of either sex to be employed under ten, though under thirteen they may, for (*a*) not more than six days a week, (*b*) not more than six hours a day, if employed more than three days a week, (*c*) not more than ten hours a day, if employed for only three days a week. Children must attend school for at least twenty hours in every two consecutive weeks of work. Managers of collieries are required to be certificated, after examination for competency by a district board; but a certificate of service may be given to those managers, who have served up to a certain date before the Act. No person to be employed about a windlass or engine under eighteen. Wages not to be paid in a public-house; and, except when payment by the day or the yard is in force, it is to be according to standard weight in the avoirdupois of the mineral raised. Workmen may appoint check-weighmen at their own cost. Special rules must be adopted at every colliery for the protection of life and limb, and facilities are given for the inspection of the mine on the part of the workmen, as well as of the owners.

The inspection of the British coal mines is carried on by twelve inspectors, each of whom has his separate district (p. 4), assisted by twelve assistant-

inspectors, the appointment of the latter dating from 1872. Considering the enormous number of the pits to be inspected in some of the districts (e. g. South Staffordshire, 517) and the length of time required for visiting a pit of any size, it seems impossible that a really strict and systematic supervision can be carried out. Moreover, some districts possess very fiery pits, entailing on the inspector an undue quantity of work and anxiety. There are, however, arguments for and against the appointment of a too large inspecting body, although it is reasonable to suppose that a more frequent inspection would go far to secure a better discipline and give confidence to the workmen. There has hitherto been a certain amount, more or less, of antagonistic feeling between the colliers and the employers—a feeling which has been unhappily fostered by the leaders of the mining class; but there seems to be a decided inclination on the part of the workpeople to co-operate in keeping up the discipline and observing the regulations, though, as stated before, there are always plenty of reckless, foolish fellows, who, if not looked after, will do infinite mischief.

The question of wages is a difficult one to write about; for, apart from the great fluctuations that have taken place of late years in every trade, that of coal mining is particularly liable to them, while every district has its local difference of wages. The last six years have seen very great changes in the prices of coal and the wages of colliers. For some time previous to 1871, they had been low; but in that year, owing to the increased activity of the iron trade,

the close of the Franco-German war, and various other causes, the trade made a great start, and wages soon followed suit. The following table, from a return made by Mr. Bunning, of Newcastle, for the American Government,* shows the rise and fall in the north of England between 1871–74 :

Date.	Advance.	Reduction.	Total Advance since 1871.	Average Daily Earnings.
	per cent.	per cent.	per cent.	*s.* *d.*
1871. Jan. to July	..	..	..	4 9
1872. Jan. and Feb.	..	..	..	5 2
„ March	20			
„ July	15	..	38	
„ December ..	..	..	..	6 6
1873. February ..	15	..	58·7	7 3
1874. April	..	10	43·4	
„ November ..	..	9	30	
„ December ..	..	..	..	6 3

It will be seen that the highest rate, before the tide turned, was at the beginning of 1873, when colliers were earning over 2*l.* per week, and in many individual cases even more. The rate in January 1875, in the same district, was :

Over-men	2*l.* to 2*l.* 15*s.*	per week.
Deputy do.	5*s.* 6*d.* to 6*s.*	per day.
Hewers	5*s.* 6*d.* „ 6*s.* 9*d.*	„
Labourers	4*s.* „ 5*s.* 6*d.*	„
Engine-men ..	5*s.* „ 5*s.* 6*d.*	„
Mechanics	4*s.* „ 5*s.*	„

At the beginning of 1876, colliers in the North were earning 26*s.* per week, with house and coal found

* 'Labour in Europe and America.' 1876.

by the owners. The following was the scale (1876) in South Wales and Staffordshire:

(*a*) Steam coal, Abertillery, Monmouthshire:
Cutting brush coal, 2*s.* per ton; large coal, 2*s.* 6½*d.* hauling, 4*s.* 2*d.* per day; door-boys, 1*s.* 7*d.*; road-men, 4*s.* 2*d.*

(*b*) Steam coal, Aberdare district:
Cutters, 1*s.* 10*d.* per ton; day work, 3*s.* 8*d.* per day; overmen, 7*s.* 6*d.*; hauliers, 3*s.* 8*d.*; fire-men, 5*s.* 10*d.*; road-men, 4*s.* 2*d.*; hitchers, 2*s.*; door-boys, 1*s.* 4*d.*; flue-men, 3*s.* 4*d.*; weighers, 3*s.* 10*d.*; smiths and strikers, 4*s.* 10*d.*; engine-men, 3*s.* 8*d.*; pump-men, 4*s.* 2*d.*; brakes-men, 4*s.* 2*d.*; incline-men, 3*s.* 4*d.*; tippers or croppers, 3*s.* 4*d.*; sawyers, 3*s.* 4*d.*

(*c*) North Staffordshire:

Over-men	50*s.* to 60*s.* per week.	
Timber-leaders	4*s.* 4*d.* to 5*s.* per day.	
Shifters	3*s.* 8*d.*	„
Putters	2*s.* 6*d.* to 3*s.* 4*d.*	„
Trappers	11*d.* „ 1*s.* 3*d.*	„
Forge-men	3*s.* 3*d.* „ 3*s.* 9*d.*	„
Furnace-men	2*s.* 6*d.*	„
Lamp-men	4*s.*	„
Sinkers	5*s.*	„
Onsetters	4*s.* „ 4*s.* 6*d.*	„
Hewers	4*s.* 6*d.*	„
Winding engine-men	4*s.* 6*d.* „ 5*s.*	„
Pumping „	4*s.*	„
Banks-men	3*s.* 9*d.*	„
Screeners	3*s.* 9*d.*	„
Weigh-men	4*s.* 6*d.*	„

There are no deductions. Cottage rents are from 2*s.* 6*d.* to 4*s.* per week.

In South Staffordshire the Birmingham agreement is in force, colliers' wages being based on eight hours a day, viz. when furnace coal is selling at 19*s.* per ton,

the wages of thick-coal miners shall be 5*s.* 6*d.*; when at 17*s.* 6*d.*, wages to be 5*s.* 6*d.*; when at 16*s.*, wages to be 4*s.*; when at 11*s.*, wages to be 3*s.* 6*d.* In the present year, a hewer in the thick coal will be earning 5*s.* to 6*s.* per day, and a loader 3*s.* 9*d.* to 4*s.* 9*d.*; thin-coal hewers, from 4*s.* to 5*s.*; loaders, 3*s.* 6*d.* to 4*s.* 6*d.* The average earnings, however, must be based on four days a week; say,

Thick-coal colliers	..	..	22*s.* 6*d.*
„ loaders	..	..	17*s.*
Thin-coal colliers ..	..	..	20*s.* to 21*s.*
„ loaders	..	..	15*s.* „ 16*s.* 6*d.*

The next list shows how numerous are the subdivisions of labour in a colliery of large size. *Underground:* Over-men (fore and back), deputies, timber leaders, hewers, shifters, stone-men, stone-putters, waste-men, helpers-up, brakes-men, drivers, flatters, putters, landing lads, couplers, switch-keepers, trappers, greasers, hauling engine-men, pumping ditto, fire-men, furnace-men, lamp-men, water-leaders, horse-keepers, rolleyway-men, set-riders, onsetters, shaftmen. *Above ground:* Winding, pumping, hauling, fan and locomotive engine-men, saddlers, gas-men, masons, boiler-menders, fire-men, heap-keepers, banks-men, horse-keepers, cart-men, platelayers, branch-drivers, waggon-greasers, coke-burners, coke-fillers, small-runners, oven-daubers, oven-levellers, horse-shoers, pick-sharpeners, strikers, boiler-builders, joiners, waggon-wrights, tub-menders, fitters, pick-carriers, tub-cleaners, weigh-men, token-men, keckers, screeners,

small-waggon boys, waiters, callers, stone teamers, branch-men, bank-riders, bankhead-men, bankbottom-men, staith-men.

In most colliery districts deductions are made for coal supplied to the workman's family, house rent, doctor, and sick fund. Too often the houses are of a very inferior description, unprovided with the commonest necessaries, and almost unfit for habitation. Some of the more recently established collieries, however, are better in this respect; but, as a rule, the collier is not well housed. Probably the greatest evil from which this class of operative suffers is that of the "butty" or "ganger" system, by which the collier places himself entirely in the hands of the middleman who employs him. There is no reason why the contract system should be a bad one; but it so frequently happens that the contractor or butty keeps a shop or a public-house, that a species of tyranny is soon established over the workman who does not deal at the shop, or drink at the beer-house. Until the Truck Inquiry Commission issued its report, the curse of the truck system was very great, and the so-called company's shops, which ought to have proved a blessing to the workmen, were just the opposite. The wages being frequently paid at or through the shop, with weekly "draws," a great temptation was placed before the collier and his wife to run up bills for goods, generally inferior, and always dear, the shop manager well knowing that he had it in his power to stop the monthly pay. By this means a door was opened for the encouragement of improvidence and dishonesty;

and many a working man, who otherwise might have had a comfortable home and saved money, drifted into bad habits and ruin. Things are now happily improved, and in nearly all colliery establishments the wages are paid at the office, while the influence of the company's shop is no more than that of the ordinary tradesman. But there is still too much of the butty system in existence, and it can only be rooted out by strict action on the part of colliery proprietors.

Before quitting the subject of colliers, it would not be right to omit mention of the part which they take in Trade Union movements. From the Report of the Registrar of Friendly Societies for 1874, it appears that in the list of trade unions there were sixteen belonging to coal miners, numbering 101,421 members, and having an annual income of 172,682*l.* Many of the Friendly Societies are on a large and flourishing scale, as is shown by the statistics of the Northumberland Miners' Mutual Confident Association :

Year.	Members.	Funds.
		£
1870	5,300	7,800
1871	7,000	9,910
1872	14,000	14,770
1873	17,000	19,000

The payments of the members are 6*d.* per fortnight, and they receive 10*s.* per week when on strike or laid up through accident. There is also a payment to families of 2*l.* on death of a member.

I will now give a few brief statistics of the yield and exports of coal for the last ten years:

Year.	Yield.	Exports.	Value.
	tons.	tons.	£
1866 ..	101,630,544		
1867 ..	104,500,480	10,415,778	5,392,452
1868 ..	103,141,157	10,837,804	5,352,525
1869 ..	107,427,557	10,595,994	5,069,574
1870 ..	110,431,192	11,702,649	5,638,371
1871 ..	117,352,028	12,747,989	6,246,133
1872 ..	123,497,316	13,211,961	10,443,920
1873 ..	127,016,747	12,617,566	13,188,511
1874 ..	125,067,916	13,927,205	11,984,621
1875 ..	133,306,485	14,475,036	9,645,962

It will be seen that the fluctuations in the relation of value to exports between 1871–75 is in direct keeping with those in wages.

In 1875 the exports were

	Tons.	Value.
		£
Coals	13,978,956	9,155,801
Coke	307,629	298,606
Fuel	258,301	203,681
Shales and oils	..	427,365

Our chief purchasers were: coals, France, Germany, Russia, and Egypt; coke, Spain, Sweden; patent fuel, France, Italy; shales and paraffins, France.

II. Iron Mining.

The kindred trade to that of coal getting is mining, under which I group all those who raise ores of iron (except the argillaceous ores of the coal seams), copper, tin, lead, zinc, &c., and who numbered, in 1871, 87,426. Of these, 20,931 are specified as iron miners; 3898 being under 20 and 17,033 above, with 2093 females. The relative ages were:

5–	10–	15–	20–	25–
25	1,093	2,780	3,630	6,295
35–	**45–**	**55–**	**65–**	**75**
3,898	2,106	854	221	29

The iron-ore districts are scattered with much impartiality throughout England. The granite rocks of Cornwall contain lodes of hæmatite and spathose; and Devonshire, in the Exmoor district and the neighbourhood of North Molton and the Barnstaple railway, has also considerable deposits of red and brown hæmatite. In Somersetshire are the Brendon Hills, where spathose ore is largely worked by the Ebbw Vale Company, and the carboniferous limestone of the Mendips, which yield brown hæmatite. Crossing the water, we have the Forest of Dean, in the upper limestone of which are "churns" or deposits of brown ore; while from

Wiltshire comes the hydrated oxide of Westbury, and from Oxfordshire (Adderbury) brown hæmatite. Northamptonshire was the first county where hydrated oxides were discovered and worked, and is, next to Yorkshire, the largest producer of these ores. The same kind is worked in a small degree in Leicestershire; while in Lincolnshire, near Brigg, an entirely new industry has been developed by the discovery of the hydrated oxide. The Midland districts, being coal fields, yield, for the greater part, argillaceous carbonates and black bands, which are intercalated with the coal seams. North Staffordshire, however, has a rather large deposit of hydrated oxide in the Churnet valley. The north-west of England is rich in red hæmatite of the most valuable description, "partly hard, mammillated or reniform, with concentric layers, some of them fibrous, others as hard as quartz; and partly soft and unctuous, admitting of excavation with the greatest facility."* The Furness district in Lancashire, and that of Cleator in Cumberland, are the respective treasure houses of this ore. While these hæmatites are found amongst the Silurian and carboniferous limestone rocks, we have in Yorkshire an entirely different state of things. In the coal measures of the West Riding are the argillaceous carbonates; but the great iron deposit of Yorkshire is in the famous Cleveland Oolite, a district, the history of which is a romance in itself, for, twenty years ago, it was a desert, without a population except the few peasants engaged in agriculture. But in 1850 Mr.

* 'British Manufacturing Industries.'

Vaughan discovered a seam of limestone under Eston Moor, and since then progress has been so rapid, that the town of Middlesbrough, where the ore is principally smelted, increased in population from 7631, in 1851, to 43,047, in 1871; while the whole country side has become one hive of mining and smelting industry. Spathose carbonate is also found in Weardale, in Durham. North Wales is not a large iron-ore producer, what there is, being principally argillaceous from the Ruabon coal district. South Wales yields vast quantities of these ores, together with deposits of brown hæmatite on the southern lip of the coal basin. The Isle of Man does not contain very much, but what there is, is spathose of excellent quality, found under nearly the same geological conditions as the Cornish ores. Ireland has an annually increasing yield of aluminous and pisolitic brown ores from under the basalt of Antrim, offering, as Professor Smyth says, "a curious geological problem, and, as it would appear, a durable fount of employment and wealth." The Scotch ores are argillaceous, with the exception of a small patch of brown hæmatite in Haddingtonshire.

The next table shows the number and yield of the iron mines of Great Britain (1874).* They are under the supervision of the coal-mine inspectors, together with two others, who deal exclusively with the metalliferous mines. It should be borne in mind that the Coal and the Metalliferous Mines Regulation Acts are two distinct Acts, and that the iron mines are legislated

* Owing to delays in publishing, the Mineral Statistics for 1875 could not be obtained.

for by the former of these two. The reason of this apparent anomaly is, that the iron mines being generally found in the neighbourhood of coal basins, it was thought advisable that they should be supervised by the same machinery. Legislation for the metalliferous mines, indeed, is of a much more recent date, the first Act being passed in 1872.

County.	No. of Iron Mines.	Yield.	Value.	No. of Miners.
		tons.	£	
Cornwall	33	45,005	34,076	
Devonshire	26	21,313	15,258	
Somersetshire	9	41,342	30,587	
Gloucestershire ..	35	171,428	148,910	273
Wiltshire	2	86,620	17,394	22
Oxfordshire	3	38,608	7,721	
Leicestershire	1	2,930	586	
Northamptonshire ..	40	1,056,478	189,156	745
Lincolnshire	7	463,239	92,647	98
Shropshire	9	303,959	93,421	
Derbyshire	8	239,292	128,172	
Nottinghamshire ..	1	228	136	
Warwickshire	7	92,214	39,528	
North Staffordshire	4	1,032,362	731,862	
South ,,	..	141,504	84,734	
Lancashire	39	914,357	1,132,595	3,222
Cheshire	..	1,000	600	
Cumberland	45	1,119,666	1,375,501	4,442
Westmoreland	4	504	350	
Yorkshire (N. Riding)	50	5,614,322	1,694,918	6,947
,, (W. Riding)	..	370,960	154,074	
Northumberland .. Durham	11	122,480	73,531	317
North Wales	3	42,227	22,765	
South ,, ...	5	661,616	339,578	
Isle of Man	2	1,143	787	
Scotland	..	2,119,771	792,161	
Ireland	24	140,360	112,089	

NOTE.—2,673,899 tons were raised in 1875, exclusive of the argillaceous ores.

There is nothing to distinguish the iron miners very particularly from the miners of other ores, except that, when the ores raised are argillaceous, and extracted from an ordinary coal mine, the workman presents the appearance of a collier. In the hæmatite ores, however, the whole character of the work is different, they being obtained either from comparatively shallow pits or from open-cast. In these cases the workman is more allied to the navvy or the quarryman. In the red hæmatite districts of Whitehaven and Furness, he is at once recognizable by the deep red peroxide which stains the clothes and features. The rate of mortality is given by the Registrar General (1871) as follows. Total 307, viz.:

10–	15–	20–	25–	35–	45–	55–	65–	75
3	13	33	56	40	55	47	38	22

but it is clear that the next entry in the mortality tables of "Miner, branch undefined, 201," should be partly included with the iron miner.

The wages of iron-ore miners have shared the same fluctuations as those of the coal miners. In the present year (1876) they are as follows:

Northamptonshire ..	from 3*s.* to 3*s.* 6*d.* per day.
Cleveland	from 4*s.* 6*d.* to 6*s.* „ (average, 5*s.* 6*d.*)
Whitehaven and Furness districts	Miners .. 28*s.* per week. Engine-men 25*s.* „ Labourers, 21*s.* to 25*s.* „

The production of iron ore of all kinds from the mines of the United Kingdom was:

	Tons.
1866	9,665,012
1867	10,021,058
1868	10,169,231
1869	11,508,525
1870	14,370,654
1871	16,334,888
1872	15,584,357
1873	15,577,499
1874	14,844,956
1875	Returns not yet published.

All this was smelted in Great Britain (compare the pig-iron returns for the same period, p. 44) and a good deal more besides, imported as follows (1875):

	Amount.	Value.
	tons.	£
Russia	3,602	28,641
Greece	10,249	14,736
Turkey	8,558	56,975
Norway	24,192	26,813
Portugal	48,277	55,891
Spain	250,641	273,757
Italy	40,109	46,859
Algeria	55,620	61,808
Other countries	17,425	18,091
Total	458,673	583,571

III. Metalliferous Mining.

I shall describe the remaining group of miners, viz. those of copper, tin, lead, &c., under one head, as the conditions under which they labour are so similar. The number working in the respective ores in England and Wales were (1871):

	Total Males.	Under 20.	Above 20.	Females.
Copper ..	3,063	852	2,211	160
Tin	10,617	3,553	7,064	932
Lead	14,563	3,131	11,432	546

and their ages as follows:

	5–	10–	15–	20–	25–
Copper	6	268	578	361	557
Tin ..	42	1,203	2,308	1,600	1,862
Lead ..	15	1,003	2,113	2,132	3,299

	35–	45–	55–	65–	75
Copper	529	420	247	79	18
Tin ..	1,515	1,177	647	225	38
Lead ..	2,714	1,885	959	360	83

The centres of industry where these workers are to be found, are principally scattered over the West of England. Cornwall and Devon yield by far the largest supplies of copper, the lodes of which occupy the outskirts of the hilly protrusions of granite, rising from out of the slate country, as also the killas (slaty

rocks) themselves. Besides these, Cumberland, Yorkshire, Lancashire, Staffordshire, and Cheshire, contribute more or less to the supply, though none of them on a large scale. In the latter county, at Alderley Edge, is a curious example of copper obtained by chemical agency from ores of low percentage. Wales, both North and South, is a great storehouse of copper ore. The Mona and Parys mines, in Anglesea, have yielded fabulous wealth since 1768, though the quarry work, which was carried on for a long period, has given place to deep workings and chemical precipitation. The counties of Carnarvon, Montgomery, Merioneth, and Cardigan yield a little, as does the Isle of Man. Ireland is a very large producer.

1874.	No. of Mines.	Yield of Ore.	Value.	Metallic Copper.
		tons.	£	tons.
Cornwall	78	40,455	201,367	2,770
Devonshire	14	12,826	52,746	916
Cumberland ..	3	819	3,663	56
Staffordshire ..	1	..	..	..
Lancashire	2	935	4,128	75
Yorkshire	1	128	2,608	35
Cheshire	1	8,184	6,475	89
Cardiganshire ..	2	93	338	5
Carnarvonshire ..	2	138	632	9
Merionethshire ..	1	5	45	..
Montgomeryshire	2	84	580	6
Anglesea	3	4,925	8,250	135
Isle of Man	1	61	289	5
Ireland	8	9,773	54,338	801

NOTE.—66,214 tons were raised in 1875.

This quantity of ore, however, is by no means sufficient to supply the requisites of the Welsh smelting

houses, which are almost entirely in South Wales and Lancashire. Vast quantities are imported, principally from Spain, Cuba, Chili, and Australia, as under:

	Copper Ores.	Copper Regulus.
	tons.	tons.
1867	73,957	28,825
1868	83,334	30,702
1869	72,199	38,769
1870	62,104	44,528
1871	48,215	30,100
1872	44,081	28,630
1873	50,561	27,754
1874	47,919	28,058
1875	53,940	32,566

Now, if we take the total produce of the kingdom for the last decade, we shall find that the decrease is startling.

	No. of Mines.	Tons.	Value.
			£
1865	203	198,298	927,938
1866	173	180,378	759,118
1867	164	158,544	699,693
1868	152	157,335	642,103
1869	136	129,953	519,912
1870	124	106,698	437,851
1871	122	97,129	387,118
1872	117	91,893	443,738
1873	122	80,188	342,708
1874	119	78,521	336,415
1875	119	66,214	

These figures certainly bear out Professor Smyth's statement,* "that years have gone by without any

* 'British Manufacturing Industries.'

extraordinary discovery, and the value of ores raised in Devon and Cornwall has sunk from 1,230,000*l.* in 1856 to 236,436*l.* in 1873." The average price of copper ore in 1874 was from 84*l.* 6*s.* to 89*l.* 12*s.*

Tin has its habitat very much in the same locality, and under the same conditions as copper; in fact, many of the mines which have yielded the latter now yield the former. In addition, moreover, to the supplies from the mines, a considerable quantity of stream tin is found. The yield of tin ore in 1875 was 11,815 tons, all raised in the counties of Cornwall, with 153 mines, and Devonshire, with 10 mines. Added to this, there are certain mines in both counties which sold their produce (called tin stuff) in the stone; besides stream works, or dressing floors, where the refuse of mines washed down the river is treated again, to extract a little more tin. Although the number of tin mines and works has generally increased in the last ten years, there has not been a corresponding increase in the amount of ore raised:

	No. of Mines.	Amount of Ore.
		tons.
1866	145	13,785
1867	117	11,066
1868	109	11,584
1869	117	13,883
1870	147	15,234
1871	145	16,898
1872	162	14,266
1873	215	14,885
1874	230	14,039
1875	145	11,815

No metal, probably, fluctuates so much in price as tin, sometimes alternating from year to year at a difference of 50*l.* per ton, e. g.:

	Per Ton.		Per Ton.
1800	£92	1850	£84
1810	145	1860	136
1820	72	1865	96
1823	184	1870	127
1830	74	1872	152
1840	81	1874	108

Apropos of this fluctuation, Mr. C. Le Neve Foster, Inspector of Mines for Cornwall, &c., in his Report for 1875 says, that the price of tin is so much lower than it was, that mines which can in any way even pay their expenses, consider themselves exceedingly fortunate.*

The next table shows the imports and exports of tin in blocks, ingots, bars, or slabs, since 1867. The former come mostly from the Banca mines, in the Dutch Strait Settlements, though since 1871, Australia (Queensland and New South Wales) has become a large producer:

	Imports.	Exports.
	tons.	tons.
1867	5,429	1,328
1868	5,625	1,104
1869	5,442	1,112
1870	4,739	5,084
1871	8,533	5,710
1872	8,342	5,769
1873	7,771	5,757
1874	9,218	7,730
1875	16,774	5,222

* 'Coal Mines Inspectors' Reports,' 1875.

Numerically speaking, the number of persons working in the British *lead* and *silver* mines (15,109) exceeds those in tin and copper put together; and it will be seen by the following table,* that the ore is much more generally scattered:

	No. of Mines.	Lead Ore.	Silver.
		tons.	oz.
Cornwall	16	3,119	85,304
Devonshire	7	451	7,809
Somersetshire	3	1,479	400
Derbyshire	118	4,301	800
Shropshire	8	7,773	1,912
Cumberland	24	2,102	1,574
Yorkshire	18	4,900	3,492
Westmoreland	5	1,372	13,704
Durham and Northumberland	21	18,839	70,336
South Wales	36	6,075	43,446
North Wales	70	16,892	94,167
Isle of Man	8	4,204	161,612
Ireland	3	1,752	6,555
Scotland	6	2,931	11,317

NOTE.—76,151 tons were raised during 1875.

The most productive district is that of the North of England, in the mountain limestone moorland extending from Northumberland to Yorkshire, the lodes being particularly valuable at Alston, in Teesdale, Weardale and Arkengarthdale. Derbyshire, which was once the great lead-mining district, is now nearly exhausted, on account of the overpowering quantities of water which occur. North Wales, particularly Denbighshire and Flintshire, is still very productive, but is subject to the same drawback of water, and Professor Smyth considers that it has seen its best days. In the slaty

rocks are included the mines of the Isle of Man, the Lakes, Scotland, Shropshire, South Wales, Durham, and Cornwall. South Wales takes the lead of these, and the more recent mines near Llanidloes bid fair to become considerable centres of industry. The lead mines found in the granite of County Wicklow and the Isle of Man are noted for the rich supplies of silver ore. As with most other ores, it will be seen that the yield has diminished during the last ten years:

	Tons.		Tons.
1866	91,051	1871	93,965
1867	93,432	1872	81,564
1868	95,236	1873	73,500
1869	96,866	1874	76,201
1870	98,176	1875	76,131

Lead mining is not altogether like that of copper or tin, in which the supplies frequently fail suddenly and locally, but it is rather that a district becomes exhausted, or falls into difficulties like those of Derbyshire, which adds so much to the expense, that the mines become not worth working.

The imports and exports for the decade are as follows. Of the former, Italy furnishes the largest quantity, and for the latter, Russia and China are our largest customers:

	Imports.	Exports.		Imports.	Exports.
	tons.	tons.		tons.	tons.
1867	45,158	29,119	1872	70,069	44,313
1868	49,461	43,885	1873	60,303	32,010
1869	52,683	51,524	1874	62,217	36,353
1870	58,634	47,802	1875	79,829	35,505
1871	65,167	44,489			

The remaining minerals, although important enough in themselves, are not so in an industrial sense, as the mines which yield them are but few, as are also the operatives employed. One table showing the number of mines and the yield in 1875 will be sufficient:

	No. of Mines.	Quantity.
		tons.
Zinc	59	17,816
Mundic, or Sulphur Ore	24 (and also from coal brasses).	56,208
Arsenic	25	3,783
Manganese	13	3,725
Ochre	16	5,045
Wolfram	2	45
Bismuth	1	
Fluor Spar	2	324
Gold Quartz	1	122

I will now briefly go into the physical and social condition of the metalliferous miners, about whom rather less is generally known than of colliers. In 1864 a report was issued by a Commission for inquiring into this question, and a very bad state of things was revealed.* Although this is now much improved, yet the peculiarities of the copper mines, such as their great depth and high temperature, always have been, and always will be, a source of difficulty. It was a common remark in Cornwall, that "a person of fifty is old for a miner." The sallowness of face, the anxious countenance, and the thin bodies of the workmen, suf-

* 'Report of Commissioners for inquiring into the Condition of all Mines,' 1864.

ficiently bear out the truth of the saying, more particularly as these are in such marked contrast with the ruddy and healthy appearance of the women and children. The diseases that usually affect them are of an asthmatic type, resulting from bronchitis, pneumonia, and, more rarely, tubercular consumption, while disease of the heart is also frequent. The causes for this unhealthy condition are obvious, viz. the immense depth of the mines, necessitating great labour in going to and coming from the work, the very high temperature, the impurity of the air, the defective drainage, and the early age at which miners commence. The first cause tends much to disease of the heart, for some of the mines are 1680 feet deep, and most of them are provided only with ladders, up and down which the workmen have to make a toilsome progress with great exertion, so much so, that cases are mentioned in the Report, where the miner spent three hours a day in going and coming. A not unfrequent means of access is the man-engine, a rod of about $1\frac{1}{2}$ feet square, down one side of which there is a series of platforms, large enough for a man to stand upon. It moves up and down by engine power, and the workman steps from the rod every now and then on to corresponding platforms in the shaft. Even this, though a very great improvement on ladders, is a not uncommon source of accident, for, unless he steps exactly at the right moment, he misses his footing. The ventilation also is usually bad. Dr. Angus Smith analysed the air from 142 mines, and found that only 17 (or 11·97 per cent.) contained the normal proportion of oxygen, while 38,

or 26·76 per cent., were impure, and 87, or 61·20 per cent., were very bad. There is rarely such ventilation in metalliferous as there is in coal mines. The passages are low and narrow, the work perhaps 50 fathoms or more from any draught, while the temperature is from 80° to 90°, or more, so that men have been known to lose 8 or 10 lb. in weight by the end of the day. The following table shows the average annual number of deaths, during five years, of 1000 miners, as compared with 1000 males, *not* miners:

Age.	Metal Miners.	Other Males.
15–25	8·90	7·12
25–35	8·96	8·84
35–45	14·30	9·99
45–55	33·51	14·76
55–65	63·17	24·12
65–75	111·23	58·61

It will be noticed how great is the excess of mortality, after the age of thirty-five. Even as compared with coal mines, the mortality of the Cornish miner is much greater, viz.:

Age.	Cornish.	Coal.
45–55	33·51	16·81
55–65	63·17	24·43
65–75	111·23	65·16

so that the excess cannot be due to the mere fact of underground work. Another cause of ill-health is the

"dry" or changing house, where the miners change their clothes before and after work. Though now improved, it was usually an ill-built, cold, draughty hut, giving ample opportunities for the men, as they arrived in a state of perspiration, to catch cold and lay the foundation of pulmonary disease. In the north of England, however, things are decidedly more favourable to the miner: most of the mines, being lead, are entered by levels, so that the descent to a great depth is an evil which the workmen do not experience to such an extent. Partly from this, and partly from the open healthy character of the country, it is stated by Dr. Peacock that the physique of the Northern miners is better than that of the Cornish, although in the matter of ventilation there is not much to choose from, both Northern and Welsh miners suffering a good deal from powder "reck" and "stour" or dust.

The total number of deaths by accident in 1875 in the metalliferous mines of Great Britain was 119, not nearly such a large proportion as that of the coal mines; but it must be remembered, that one of the most fruitful causes of death in the latter, viz. explosion by fire-damp, is absent in the former. The accidents mainly arise from blasting, falling away from ladders, falls of rock and stuff, the occasional bursting of boilers, and unfenced shafts.

In Cornwall and Devonshire the workmen are principally composed of two classes, viz. tributers and tut workers. The latter are contractors who drive levels and shafts, &c.; while the former get the ore out from the lodes when opened by the tut workers,

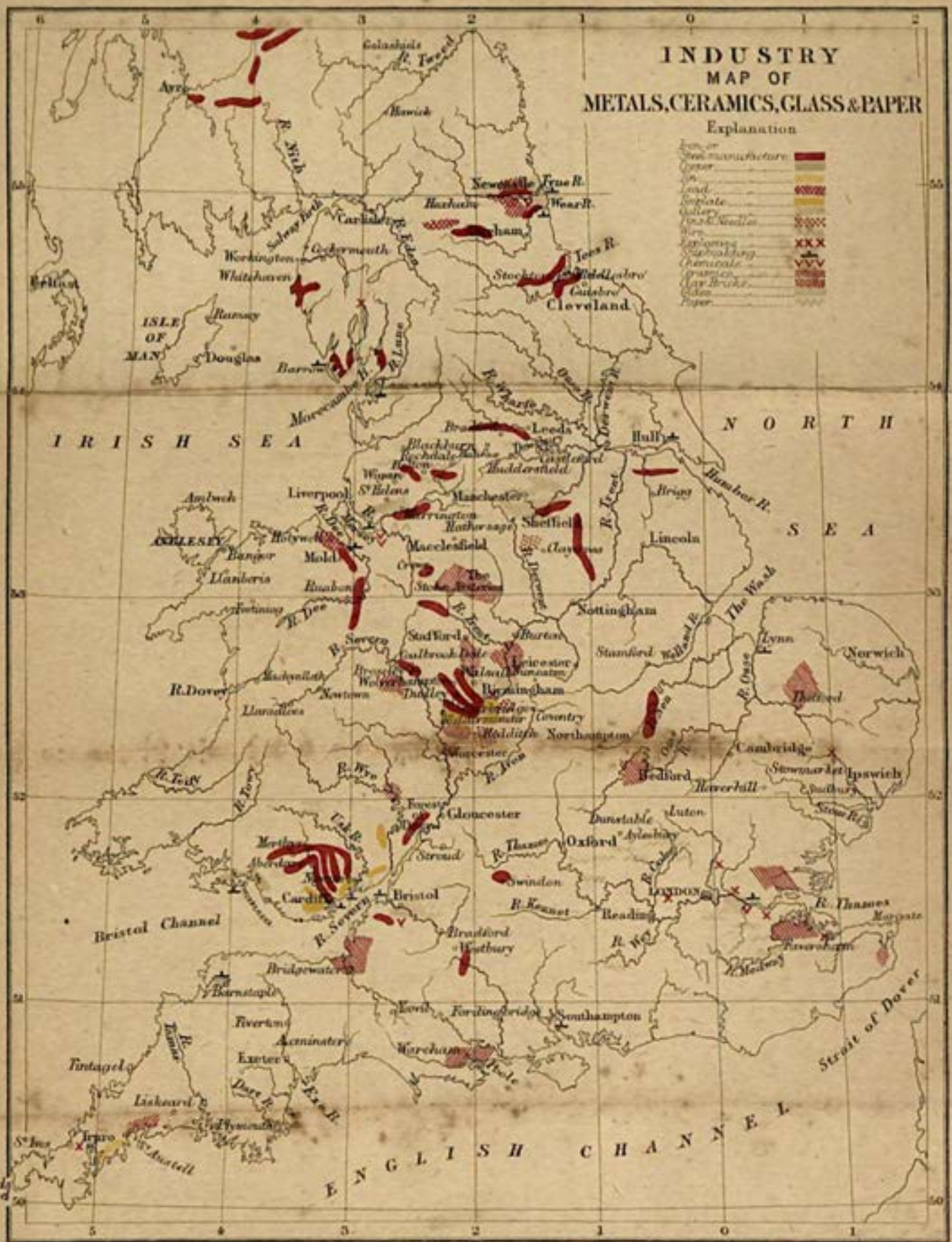
and are paid so much in the pound of the market value. They work in "pairs," or companies of from two to eight men. Mr. Le Neve Foster gives in his Report for 1875 * the average wages per month:

	£	s.	d.		£	s.	d.
1872	3	16	3	1874	3	13	7
1873	4	1	6	1875	3	10	0

This is for work, on an average, of five "shifts" a week, each of eight hours, and after deductions for materials, doctor, club, &c. For some time past, and especially in the present year (1876), the prices of metals, and particularly tin, have been very fluctuating and low, so that the wages have suffered a corresponding reduction; indeed many of the miners have not made 3*l.* for any month during the year. In consequence, too, of the demand in Australia for tin and copper miners, there has been considerable emigration and the labour market has been much unsettled.

It is only recently that the British metalliferous mines have been taken under supervision, and they are now specially under the care of two inspectors, together with the coal mine inspectors, who take charge of the ironstone mines. The Metalliferous Mines Regulation Act of 1872 (35 & 36 Vic. c. 77) is substantially the same in its provisions as that of the coal mines.

* 'Coal Mines Inspectors' Reports,' 1875.


INDUSTRY
MAP OF
METALS, CERAMICS, GLASS & PAPER
Explanation
IRISH SEA
NORTH SEA
ENGLISH CHANNEL
Bristol Channel
Strait of Dover
ISLE OF MAN
Cleveland
Lincoln
Nottingham
Leeds
Hull
Liverpool
Manchester
Sheffield
Birmingham
Norwich
Cambridge
Ipswich
Bedford
Northampton
Gloucester
Oxford
Swindon
Bristol
Cardiff
Reading
LONDON
Luton
Dunstable
Southampton
Exeter
Plymouth
Penzance
Truro
Land's End
Norwich
Lynn
Stamford
Leicester
Derby
Stafford
Wolverhampton
Coventry
Worcester
Hereford
Shrewsbury
Chester
Wrexham
Carlisle
Workington
Whitehaven
Barrow
Douglas
Ramsey
Belfast
Ayr
Berwick
Newcastle
Durham
Darlington
Middlesbro'
Stockton
Scarborough
Whitby
Bridlington
Grimsby
Brigg
Doncaster
Barnsley
Huddersfield
Halifax
Bradford
Blackburn
Preston
Wigan
St Helens
Warrington
Macclesfield
Crewe
Stoke
Burton
Rugby
Northampton
Aylesbury
Luton
Hertford
Ware
Chelmsford
Colchester
Ipswich
Sudbury
Newmarket
Thetford
Yarmouth
Lowestoft
Margate
Ramsgate
Canterbury
Maidstone
Tunbridge Wells
Brighton
Portsmouth
Chichester
Salisbury
Winchester
Andover
Basingstoke
Aldershot
Guildford
Dorking
Reigate
Croydon
Kingston
Hampton Court
Windsor
Slough
Maidenhead
Henley
Wallingford
Abingdon
Banbury
Stratford
Evesham
Tewkesbury
Cheltenham
Stroud
Gloucester
Monmouth
Abergavenny
Newport
Cardiff
Swansea
Carmarthen
Haverfordwest
Pembroke
Milford Haven
Aberystwyth
Machynlleth
Newtown
Welshpool
Oswestry
Wrexham
Mold
Rhyl
Bangor
Holyhead
Llanberis
Llandudno
Conway
Colwyn Bay
Llandudno
Anglesey
Caernarvon
Pwllheli
Barmouth
Dolgelly
Aberystwyth
Cardigan
Tenby
Carmarthen
Llanelly
Neath
Port Talbot
Bridgend
Pontypridd
Merthyr Tydfil
Abergavenny
Hereford
Ludlow
Shrewsbury
Oswestry
Whitchurch
Nantwich
Crewe
Stafford
Lichfield
Tamworth
Nuneaton
Rugby
Leamington
Warwick
Kenilworth
Coventry
Birmingham
Wolverhampton
Dudley
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Cannock
Burton
Derby
Matlock
Chesterfield
Rotherham
Barnsley
Wakefield
Dewsbury
Halifax
Bradford
Keighley
Skipton
Settle
Clitheroe
Blackburn
Bolton
Wigan
Warrington
Runcorn
Widnes
Chester
Ellesmere Port
Birkenhead
Liverpool
Southport
Ormskirk
Preston
Lancaster
Morecambe
Barrow
Ulverston
Whitehaven
Workington
Cockermouth
Keswick
Penrith
Carlisle
Brampton
Hexham
Newcastle
Gateshead
Sunderland
Durham
Darlington
Richmond
Northallerton
Thirsk
Malton
Scarborough
Whitby
Filey
Bridlington
Driffield
Beverley
Hull
Goole
Selby
York
Harrogate
Ripon
Knaresborough
Wetherby
Otley
Ilkley
Keighley
Bradford
Halifax
Huddersfield
Dewsbury
Wakefield
Pontefract
Castleford
Leeds
Morley
Batley
Ossett
Wakefield
Doncaster
Scunthorpe
Gainsborough
Lincoln
Grantham
Sleaford
Boston
Spalding
Peterborough
Stamford
Oakham
Melton Mowbray
Loughborough
Leicester
Hinckley
Nuneaton
Atherstone
Tamworth
Lichfield
Cannock
Walsall
Dudley
Wolverhampton
Kidderminster
Bewdley
Stourport
Worcester
Droitwich
Redditch
Bromsgrove
Alcester
Stratford
Banbury
Bicester
Aylesbury
Amersham
High Wycombe
Maidenhead
Windsor
Staines
Egham
Weybridge
Kingston
Croydon
Sutton
Epsom
Dorking
Guildford
Godalming
Haslemere
Petersfield
Havant
Portsmouth
Fareham
Southampton
Romsey
Salisbury
Amesbury
Devizes
Marlborough
Swindon
Cirencester
Tetbury
Malmesbury
Chippenham
Calne
Melksham
Trowbridge
Frome
Shepton Mallet
Wells
Glastonbury
Bridgwater
Taunton
Wellington
Tiverton
Crediton
Okehampton
Launceston
Bude
Wadebridge
Camelford
Padstow
Newquay
St Austell
Truro
Falmouth
Helston
Penzance
St Ives
Redruth
Camborne
Hayle
Launceston
Tavistock
Plymouth
Saltash
Liskeard
Looe
Fowey
Par
St Austell
Truro
Penryn
Falmouth
Helston
Penzance
St Ives
Redruth
Camborne
Hayle
Land's End
Lizard Point
Start Point
Portland Bill
Beachy Head
Dungeness
North Foreland
Isle of Wight
Needles
Hurst Castle
Selsey Bill
Shoreham
Brighton
Eastbourne
Hastings
Rye
Winchelsea
Ashford
Folkestone
Dover
Deal
Sandwich
Ramsgate
Margate
Whitstable
Faversham
Sittingbourne
Rochester
Chatham
Gravesend
Dartford
Erith
Woolwich
Greenwich
Deptford
Lewisham
Bromley
Sevenoaks
Tonbridge
Tunbridge Wells
Uckfield
Lewes
Newhaven
Seaford
Eastbourne
Pevensey
Battle
Hastings
Rye
Winchelsea
Hythe
Romney
Dover
Canterbury
Whitstable
Herne Bay
Margate
Ramsgate
Sandwich
Deal
Walmer
Dover
Folkestone
Ashford
Tenterden
Cranbrook
Maidstone
Tonbridge
Sevenoaks
Dartford
Gravesend
Rochester
Chatham
Sittingbourne
Faversham
Whitstable
Canterbury
Ashford
Folkestone
Dover
Deal
Sandwich
Ramsgate
Margate
Herne Bay

CHAPTER II.

THE METAL MANUFACTURES.

I. Iron.

In treating of the very large and important division of workers in Metal Manufactures, I propose to take, in the first group, those only who are employed in the conversion of the raw to the finished material, leaving the many and various trades which are dependent upon these metals to be described under their respective localities.

The iron trade, for instance, which has so essentially contributed to the greatness of this country, is scattered all over the kingdom, wherever iron or coal is to be found; but when we come to the ramifications and minute subdivisions of articles, we find that they affect special localities, such as Birmingham, Wolverhampton, Sheffield, &c. Next to textile operatives, colliers and miners, the iron trade is numerically the most important body of workers in Great Britain. In England and Wales they amounted to (1871) 178,114, of whom 38,744 were under twenty, and 139,370 above that age. The relative years were as follows:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
67	9,544	29,133	29,942	48,159	31,294	18,153	8,476	2,783	563

In this list are not included workers in iron, such as white- or blacksmiths, nail, chain, or anchor makers, ironmongers, &c.; but merely those engaged in smelting the iron from the ore, and afterwards converting the pig into finished iron by puddling, rolling, &c., in fact, those who work in blast furnaces, mills, and forges. To the 178,114 ironworkers of England and Wales, we must add 1715 for Ireland, and 58,075 for Scotland, besides 2093 females, which will bring up the total to 239,997.

The following was the average age of the latter:

Total 2093: under 20, 1065; above 20, 1028.

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
3	211	851	403	281	143	116	53	24	6

by which it will be seen that the majority of women workers are young girls. The next table will show the districts where these people are employed; and it will be at once evident, that one of two things has been the cause of this localization; either the presence of coal, or of iron ore, or of both together. In former years the argillaceous ores were almost the only ones used for smelting iron (I am, of course, not referring to the early history of the trade), and consequently all the furnaces were built in the coalfield, close to the ore and the coal supply; or, maybe, at the outcrop of the basin, as in the South Wales district, where the limestone, used as a flux, was easily accessible. But as time went on, these ores became either exhausted or expensive to work, while other ores

(hæmatites) were discovered and raised in different parts of England where no coal was. It then began to be seen, that it would pay to erect furnaces amongst the ore districts and bring the coal to them from the nearest basin, so that the trade gradually extended to various localities, such as Cleveland, Cumberland, and Northamptonshire and Lincolnshire. In point of fact, as regards plant and appliances, the vitality of the trade is rather in these new districts than the old ones, where things have a tendency to run in obsolete grooves.

1874.	Active Works.	No. of Furnaces Built.	Ditto in Blast.	Tons of Pig.	No. of Puddling Furnaces.	No. of Rolling Mills.
Northumberland ..	2	5	2	33,142	964	52
Durham	14	55	49	829,235		
Yorkshire (North Riding)..	21	97	85	1,158,471	694	37
Yorkshire (West Riding)..	13	44	31	163,856	530	105
Derbyshire	13	50	38	301,687	109	14
Lancashire	9	47	33	488,672	376	69
Cumberland	10	51	30	390,840	79	12
Shropshire	11	28	20	126,053	183	26
North Staffordshire	8	39	28	273,501	454	39
South "	50	154	81	452,400	2,073	320
Northamptonshire..	7	18	14	53,760		
Lincolnshire	3	15	8	67,266		
Gloucestershire ..	3	10	6	43,139	3	2
Wilts	1	7	3			
Hants	1	1	1	35,115		
Somersetshire	1	1	1	..	10	3
Denbighshire	3	9	6	57,868	57	7
Flintshire	1	2	2			
Glamorganshire .. Caermarthenshire ..	17	87	47	334,244	510	84
Monmouthshire ..	13	62	41	360,480	419	47
Ayrshire	7	48	37	240,667		
Lanarkshire	13	93	72	501,541	342	49
Fifeshire	2	6	3	13,854		
Linlithgowshire ..	2	9	5	35,778		
Stirlingshire .. .. Argyleshire	2	7	6	15,837		

The Returns of 1875 are not yet obtainable, owing to delay in publishing the Mineral Statistics.

The fluctuations in the iron trade are seen, by comparing the numbers of furnaces built with those in blast. In 1874, one-third of the entire number in Great Britain were idle, and this was considerably increased in 1875, and the present year (1876). The trade is now undergoing one of its longest and deepest fits of depression, and it is impossible to say how long this may last, for there appears to be certain abiding causes for its continuance, which have not been present in preceding years.

The divisions of labour in a blast furnace are not very many; for it must be remembered that an iron work need not include puddling or rolling process; but merely, as in Northamptonshire and Wilts, the making of pig iron. The workmen engaged in this are keepers, fillers, cinder-men, chargers, slaggers, brakes-men (for the hoists), mine, coke, and limestone fillers, spare keepers, table loaders, blast-engine-men, gas-stove-men, limestone breakers, calcining kiln-men, &c. Roughly speaking, the hands may be divided into two sets, those who attend to the furnace itself and those who prepare the materials for filling it, the former being naturally a more skilled and experienced class of operatives than the latter. Mr. Mattieu Williams has so well described the construction of a blast furnace in his article on *Iron and Steel*,* that I need only refer my reader to it. The furnaces, whatever their number, are connected by continuous bridges or platforms on the summit, where they are filled, and they are usually kept burning day and night for years,

* 'British Manufacturing Industries.'

except when blown out for repairs or in bad times. Those who have travelled by rail through the Black country, are familiar with the Pandemonium-like appearance of the district after dark. The average number of men employed about a furnace is twenty-four, viz. twelve during the day, and the same number at night. In many districts, even the recurrence of Sunday forms no interruption to the work, it being a tradition amongst iron workers, that the cost of knocking off for that period of time was too great to allow of it. It has, however, been found, that by charging the furnaces with additional fuel on Friday and Saturday, they will keep hot till Monday; and, acting upon this, the number of furnaces idle during Sunday has been gradually increasing. Boys used to be largely, and still are partially, employed about furnaces, principally as "box-fillers," filling and bringing to the furnace mouth the iron barrows or boxes containing the measured charges of material. The arrangements at different works depend a good deal upon the locality. In South Wales more juvenile labour is employed, and also women, a practice which arose doubtless from the Welsh works having been originally established in remote valleys, and from labour having been consequently scarce, and also because there was no other competing labour in the district, as in Staffordshire. The girls in Wales help to unload coals, break limestone and fill the boxes, and though the work is laborious, it is not degrading nor unhealthy, except perhaps that it is attended with a good deal of dust. This, however, is not felt much, as it is out of doors.

Neither, as a rule, is furnace work unhealthy, though when the immense heat to which the men are subject while casting the molten metal, is felt, even at a considerable distance, it is a matter of wonder that the constitution can stand such exposure. To meet it, they are clad in as little costume as is compatible with decency, while they imbibe great quantities of tea or some other light drink. According to the Registrar-General, men engaged in iron manufacture do not die above the average rate under forty-five; but after that, the tables are turned and they die rather rapidly. The following table is for 1871. Total mortality of workmen, 2377:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
..	20	132	275	462	395	371	333	246	143

This list includes not only furnace men, but also puddlers, rollers, &c., all of whom are more or less exposed to great heat. Accidents about blast furnaces are not of very common occurrence; but the men are subject to injuries to the eye, in consequence of specks of iron flying in and getting fixed into the cornea. Amaurosis too is frequently observed, probably arising from the glare of the furnace. Blast-furnace-men usually get a higher rate of wage than other iron operatives; and in good times can clear large sums in the year. In 1871 the earnings in the north of England were:

Keepers	50*s.* 9*d.*	per week.
Chargers	38*s.* 6*d.* to 42*s.*	„
Slaggers	28*s.* to 31*s.* 6*d.*	„
Mine-fillers	29*s.*	„
Coke-fillers	22*s.* 6*d.* to 23*s.* 4*d.*	„
Lime-fillers	22*s.* 6*d.*	„
Engine-men	18*s.* to 28*s.*	„
Weigh-men	18*s.* „ 28*s.*	„
Labourers	18*s.* „ 22*s.*	„
Masons	18*s.* „ 25*s.*	„

In 1876 they were as follows:

MIDDLESBRO'.

Keepers, large furnaces	71*s.* 4*d.*	per week.
„ small	54*s.* 6*d.*	„
Chargers, large	54*s.* 4*d.*	„
„ small	41*s.*	„
Slaggers, large	42*s.*	„
„ small	36*s.* 6*d.*	„
Blast-engine-men	58*s.* 6*d.*	„
„ engine cleaners	23*s.* 9*d.*	„
„ „ donkey-men	31*s.*	„
„ „ boiler minders ..	34*s.* 6*d.*	„
„ „ labourers	28*s.* 6*d.*	„
Weighers of mine	22*s.* 6*d.*	„
„ metal	34*s.*	„
Fillers, mine	36*s.* 6*d.*	„
„ limestone	29*s.* 10*d.*	„
Breaking „	29*s.* 10*d.*	„
Coke-fillers	16*s.* 10*d.* to 26*s.*	„

SOUTH WALES.

Blast-furnace-men	3*s.* 7*d.* to 10*s.*	per day.
Metal breakers	5*s.* 3*d.*	„
Refiners	7*s.* 4*d.*	„
Hauliers	2*s.* 4*d.* to 3*s.* 4*d.*	„
Cokers	4*s.* 0*d.* „ 4*s.* 9*d.*	„
Engine-men	24*s.* to 35*s.*	per week.
Stokers	19*s.* „ 25*s.*	„

NORTH STAFFORDSHIRE (many of the wages paid by the ton).

Keepers	6*d.* per ton net.
Chargers }	6*d.* per ton less
Slaggers }	20 per cent.
Fillers	1*s.* per ton.
Pig-lifters	2*d.* „
Engine-men	4*s.* 4*d.* to 5*s.* per day.
Labourers	3*s.* „

The production of pig iron in Great Britain for the decade was:

	Tons.		Tons.
1866	4,523,897	1871	6,627,179
1867	4,761,023	1872	6,741,929
1868	4,970,206	1873	6,566,451
1869	5,445,757	1874	5,991,408
1870	5,963,515	1875	Returns not received.

and the exports:

	Tons.	Value.
		£
1870	753,339	2,229,045
1871	1,057,458	3,229,408
1872	1,332,726	6,721,966
1873	1,142,065	7,118,037
1874	776,116	3,673,734
1875	954,475	3,474,621

The rapid and abnormal rise in the price of iron will be noticed during the inflated years 1872–3.

Our best customers at present for pig iron are Holland and Germany, far behind which come Belgium, France, Russia, America, and others.

The process, by which pig is converted into malleable iron, is that of "puddling," and in large works is usually (though not necessarily) carried on adjoining the furnaces in large iron sheds, open at the sides and floored with iron plates. The work consists in charging the puddling furnaces with coal and pig, puddling or stirring the metal as it melts and boils, dividing it into lumps of proper dimensions, drawing out the lumps as soon as the iron has come to "nature," and handing them over to the "shinglers" to be placed under the hammer. Owing to the peculiar character of the work, the puddler forms a class by himself. To make a good puddler, a man should be brought up to it from boyhood; and hence it is that a certain hereditary speciality has (or had, until the last few years) descended from father to son. The operations which I have first mentioned constitute a "heat," each occupying from one and three-quarters to two hours, and six heats making a "turn." The time consumed in puddling and working up the iron is generally about three-quarters of an hour, and the labour is very severe, the puddler being subjected to great heat, glare, and violent exertion, from which causes, it is said, this class seldom lasts above fifty. On the other hand, the labour is not continuous, for he has alternate periods of rest during the time that the iron in the furnace does not require his services. He always has an "under-hand," and sometimes two, to assist him, these being occasionally men, but more frequently boys.*

* I do not notice the artificial puddling, as it is so completely experimental as yet.

As soon as the puddler has delivered the white-hot mass of iron, weighing about 1 cwt., to the "shingler," the latter (also with his under-hand) swings it under the helve or hammer, a ponderous giant, which soon reduces the shapeless lump into a solid block, sending out showers of fire during the operation of squeezing out the slag. Lads are employed here too, as "staff carriers," viz. heating the iron rods and taking them to the shingler to weld into the puddled "bloom" and thus enable him to move it under the hammer.

The rolling mill is the next stage. The puddled iron, after having been shingled, is taken to the rolls, of which there are several pairs of different sizes, the iron being passed through the largest size rolls first of all, so as to reduce it to dimensions sufficient to pass through the next. At this point, the iron manufacture diverges a good deal, according as the finished iron is intended for rails, plates, bars, rods, wire, &c. Rolling requires great experience and quickness. In rolling heavy plates, such as armour plates, none but adults can work; but in lighter iron, such as rods or wire, boys are strong enough for the labour and more active than men. A rolling mill is to the uninitiated a scene of the wildest confusion, and indeed is a rather dangerous place to visit. The noise of the fly wheels and the rollers, the thud of the hammer, and the shouts of the workers are positively alarming, added to which the glare of the white-hot masses, moving rapidly and apparently by invisible agency, with the long sinuous coils of iron darting about like fiery serpents, make a most bewildering scene.

Accidents are frequent, and especially from burns,

though, considering all the circumstances, it is wonderful that they do not happen oftener, or that they are not of more serious import. Women are not much employed in iron mills, except in South Wales, where they sweep the floor, and are also engaged in "piling," which means, making up the piles or stacks of puddled iron ready for reheating in the mill furnace. In South Staffordshire they occasionally find work in wheeling cinders, for which they get 7*s.* to 8*s.* per week. In all England and Wales, 2155 were employed in 1871, of whom nine-tenths were in the Principality, the total of all workers being:

	Males.	Females.
Blast and puddling furnaces	117,973	2,596
Rolling mills, forges	26,200	2,158

The wages of puddlers, &c., are high. In 1871 they were as follows:

Puddlers	42*s.* to 43*s.*	per week.
Shinglers	55*s.*	„
Weigh-men	18*s.* to 24*s.*	„
Rollers	65*s.* to 85*s.*	„
Roughers and catchers ..	50*s.*	„
Pilers	26*s.*	„
Sawyers (rails)	39*s.*	„
Straighteners	26*s.*	„
Heaters	35*s.* 6*d.* to 42*s.* 6*d.*	„
Smiths	20*s.* to 29*s.*	„
Moulders	20*s.* to 28*s.*	„

The standard wages adopted in 1871 underwent an addition of 6*d.* per ton on puddling prices and 5 per

cent. on other wages, and a further addition of similar amount was made in 1872. In South Staffordshire the aggregate advance amounted to 30 per cent. on the fixed rates. Having reached the maximum, they gradually declined, until in October 1874, they were established at an advance of 12 per cent. on the standard of 1871.*

In 1876 the wages in South Wales were:

Rollers	8*s.* 2*d.*	per day.
Heaters	5*s.* 1*d.* to 7*s.* 1*d.*	„
Bloomers and roughers ..	6*s.* 6*d.* to 7*s.*	„
Hookers, sawyers, and straighteners	3*s.* 9*d.* to 4*s.* 3*d.*	„
Cold straighteners	7*s.* 4*d.*	„
Roll turners	4*s.*	„
Puddlers	5*s.*	„
Squeezers	6*s.* 2*d.*	„
Helpers to puddlers	2*s.* 10*d.*	„
Boys	1*s.* 9*d.* to 2*s.* 2*d.*	„

MIDDLESBRO'.

Puddler, level hands ..	28*s.*
„ fore-hands ..	36*s.* 7*d.*
„ under-hand ..	17*s.* 9*d.*
Shinglers	52*s.* to 62*s.*
Heaters	33*s.* 1*d.* to 55*s.* 6*d.*
Rollers	75*s.*
Roughers	58*s.* 1*d.*
Catchers	45*s.* 9*d.*
Bogey-men	24*s.* 5*d.* to 27*s.* 6*d.*
Pilers	24*s.*
Straighteners	20*s.* 9*d.* to 39*s.* 4*d.*
Sawyers	24*s.* 5*d.*

* 'Labour in Europe and America,' 1876.

PLATE MILLS.

Heaters	43*s.* 8*d.*		per week.
Rollers	63*s.* 5*d.*		„
Shearers	73*s.* 9*d.*		„
Pilers	42*s.* 5*d.*		„
Pattern makers	30*s.*	to 36*s.* 4*d.*	„
Fitters	26*s.* 5*d.*	„ 36*s.* 4*d.*	„
Smiths	29*s.*	„ 36*s.*	„
Strikers	23*s.*	„ 25*s.* 6*d.*	„
Platers	39*s.* 6*d.*		„
Riveters	35*s.* 9*d.*		„
Moulders	24*s.* to 36*s.*		„

NORTH STAFFORDSHIRE.

Puddlers (first hands) ..	8*s.* 9*d.* per ton.
Shinglers	11*d.* „
Smiths	4*s.* 8*d.* and 4*s.* 10*d.* per day.
Boiler smiths	4*s.* 6*d.* „
Fitters	5*s.* 2*d.* „

For legislative purposes, all blast furnaces, iron mills, and foundries were included in the Factory Extension Act of 1867. The peculiarity of the work prevented their coming under the Act of 1874, seeing that a portion of it, viz. puddling, is in heats, irrespective of time, and it is impossible to break into these heats. This is partly dependent on the character of the iron, for the larger and heavier it is, the longer it takes to heat. Before the Act of 1867 came into force, boys were taken very young into furnaces and mills, and although the work was heavy for them, they got used to it, and were able to become "under-hands" at an early age. Now, they are not allowed to commence till thirteen, and this is considered a grievance by many masters, who say that the boys of that age do not learn their

business, so that the works are constantly at a stand-still through their irregularity; added to this, there is such a scarcity of boys' labour, and it costs so much more to obtain it (fully 30 per cent. more than a few years ago), that it is almost as advantageous to employ men at once. These circumstances, combined with the Coal Mines Regulation Act, have created a restriction of labour and have tended to increase the cost of production. The amount of idle time in forges and mills is very large. Putting aside the legal holidays, there is always the recognized "St. Monday," which practically includes Tuesday, added to which, breakages and strikes form a too frequent interruption. These habits of intermittent work have not told well on this class of operatives, who are sadly inclined to improvidence and wasting their substance in drink and riotous living. Furnace-men, who work more regularly, are, as a rule, steadier in their habits.

Our imports of wrought and unwrought iron were (principally from Belgium and Holland):

	Wrought Bars.	Unwrought Bars.
	cwt.	tons.
1870	634,397	74,149
1871	446,040	74,538
1872	782,044	82,888
1873	620,018	74,490
1874	1,055,424	74,173
1875	1,160,050	91,515

and the exports, including bar, angle, rod, bolt, railway, wire, hoops, sheet, boiler, armour, and plates:

	Tons.		Tons.
1870	2,072,236	1873	1,815,748
1871	2,111,761	1874	1,711,406
1872	2,055,896	1875	1,511,165

In 1875 the exports of iron of all kinds were as follows:

	Tons.	Value.
		£
Iron ore	2,458	7,868
„ old, for re-manufacture	21,610	102,837
„ pig	942,352	3,415,940
„ puddled	5,475	33,976
„ bar	238,586	2,345,195
„ angle	8,290	85,397
„ bolt and rod	29,192	295,315
„ rails and tie-rods	490,741	4,615,452
„ wheels and axles	13,731	320,208
„ railroad	41,509	518,176
„ sheets, boiler, and armour plates	88,255	1,339,598
„ galvanized	50,198	1,227,745
„ hoops	66,030	736,805
„ wire (except telegraph) ..	42,221	780,037
„ anchors and chains	24,296	479,293
„ tin plates	138,363	3,686,607
„ tubes and pipes	200	530,245
„ nails and rivets	17,106	528,321
„ cast and wrought (except ordnance)	173,267	2,804,633

Our chief customers were: Russia, old iron; Holland and Germany, pig; Canada, puddled; Russia and Italy, bar; India and Germany, angle; China, bolt and rod; Russia, rail and tie-rods, with wheels and axles; Argentine Republic, railroad; Germany, sheets and plates;

United States, tin plates; Australia, galvanized; India and America, hoops; Australia, wire; Sweden and Norway, anchors and chains; Germany, tubes and pipes; Australia, nails.

The principal societies belonging to the iron trade are the National Amalgamated Association of Iron, Steel, Tin, and Blast Furnace Workers, with head quarters at Darlington; the National Association of Blast Furnace-men, Stockton-on-Tees; and the Iron-founders' Society of England, Ireland, and Wales. This latter started in 1850, with 4073 members, and has now over 12,000, with funds in hand exceeding 50,000*l.*

II. Steel.

Of late years the steel trade has very much developed in its proportions, owing to the increased demand for steel rails, which have been found to be much more durable than iron. The number of workers employed, according to the Census, was 5719; but the steel manufacture is so intimately linked with that of iron, that very many would be possibly returned in the one, who worked in the other; added to which, a good many more steel works have been opened since 1871. The relative ages of the workers were:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
1	250	848	945	1617	1116	578	255	87	22

Sheffield is the principal head-quarters of the manufacture; but many large iron firms have been gradually adding it to their ironworks, and we now find Bessemer

converters at Ebbw Vale and Dowlais in South Wales, Crewe, Workington, Rotherham, Wednesbury, Liverpool, Gorton, Bolton, Glasgow, Barrow, Carnforth, &c., to the amount, in 1874, of 21.

The following are the average wages for 1876 of a Bessemer steel worker:

Bessemer converting department:		
Leading men	7*s.* 6*d.* to 8*s.*	per day.
Labourers	4*s.*	„
Hammer-men:		
Ordinary	5*s.* 6*d.*	„
(Leading men are contractors.)		
Furnace-men:		
Leading men	12*s.*	„
Ordinary	8*s.*	„
Rollers:		
Leading men	10*s.*	„
Ordinary	4*s.* 9*d.*	„
Rail finishers:		
General labourers	3*s.* 6*d.* to 3*s.* 9*d.*	„
Boys	1*s.* 6*d.* to 2*s.* 6*d.*	„

Steel making by the cementation process is carried on almost entirely at Sheffield, but the Bessemer process has very largely superseded it. Mr. Mattieu Williams has given so graphic a description of the beauties of the latter, that I need only refer to his article on Steel.* The work requires very much the same class of operatives as does the iron trade, although in certain of the operations, perhaps, the heat to which the workmen are exposed is more intense. Boys are largely employed, especially in the cementation process: and Mr. White, in his Report to the Children's Employment Commission, called attention

* 'British Manufacturing Industries.'

to the objectionable work-places, or "cellars," beneath the furnaces and below the level of the ground, in which the boys passed most of their time, having the melting pots immediately over their heads. The "turns" in this class of melting are regulated by the pots, which become so worn out by the heat, that they cannot be used for more than three rounds without loss from the waste of metal; and these rounds are usually completed within the twelve hours. Boys are also employed in "firing," viz. standing in front of the furnace, from which they take out large bars of steel, used for springs, and hand them to a man, who cuts them by a machine; in "pulling down," or dragging the hot iron from the rollers with tongs; working clay for pot lids; "holding up" the doors through which the hot metal is drawn out, &c. The following table gives an idea of the weekly earnings of this class of workmen:

	1871.	1872.	1876.
Converter	29*s.* to 34*s.*		30*s.* to 35*s.*
Melter	33*s.*	48*s.* 6*d.*	36*s.* „ 50*s.*
Puller out	27*s.* 9*d.*	28*s.*	30*s.* „ 34*s.*
Coker	17*s.* 6*d.*	19*s.* 6*d.*	22*s.* „ 26*s.*
Lightor up	28*s.*		
Forge-man and tilter ..	35*s.*		50*s.* „ 60*s.*
Lifter up (boy)	7*s.*		
*Armour-plate labourer	27*s.*		28*s.* „ 45*s.*
Rod-roller	50*s.* to 60*s.*		45*s.* „ 50*s.*
Rod furnace-man ..	20*s.* 6*d.*		20*s.* „ 24*s.*
Spring-fitter	60*s.*		48*s.* „ 50*s.*
Sheet-roller	38*s.* 9*d.*		42*s.*
Sheet furnace-man ..	29*s.* 3*d.*		27*s.*
Teemer	39*s.*	39*s.*	36*s.* to 50*s.*
Wire-drawer	40*s.*		40*s.* „ 60*s.*
Boys	5*s.* to 17*s.* 6*d.*		8*s.* „ 16*s.*

* Armour-plates are rolled by contractors, who are paid on the tonnage, and employ the labourers.

The "tilters," are the men who hammer the steel into rods and bars as required; while the "teemers" empty the crucible steel, while in a liquid state, into the ingot moulds. Wages at the present time have shared the general depression; but, *apropos* of this, it should be mentioned that a very important change was made, in 1874, at Sir John Brown and Company's (Limited) works at Sheffield, by an increase in the hours of labour for the men, viz. the extension from fifty-four to fifty-nine. This was only following the example of the Belgians, where all the operatives work ten hours a day. The following is a table of the exports of *unwrought* steel since 1870, principally to the United States:

	Tons.	Value.
		£
1870	34,962	1,103,936
1871	39,189	1,198,428
1872	45,285	1,491,240
1873	39,418	1,462,857
1874	31,440	1,203,719
1875	29,733	1,870,446

In 1875 the exports were as follows:

	Tons.	Value.
		£
Steel, cast in ingots	109	3,635
„ bar, of all kinds	26,727	970,400
„ sheets	3,022	99,638
„ manufactures	11,026	827,758

the United States taking most of the bar and sheets, and Russia the manufactured steel.

III. Copper.

The numbers engaged in this trade are not very many, and it is one that is more localized than that of iron. By far the largest portion of the copper ore, whether raised in England or imported from South America, Australia, or elsewhere, is brought to Glamorganshire and Caermarthenshire, where in the towns of Swansea, Neath, Briton Ferry, Port Talbot, Aberavon, and Llanelly, copper smelting has been established since the commencement of the last century. Lancashire (Sutton and Ravenhead, near St. Helens) is the only other centre of this industry. In 1871 the copper manufacture employed 3289, viz.:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
..	151	404	414	772	689	464	276	94	25

There were also 160 females, out of which 51 were employed in copper mills, according to the Factory Returns of 1871. These mills were located, to the number of twenty-four, in the counties of Anglesea, Caermarthen, Glamorgan, Stafford, Surrey, Worcester, and Northumberland.

In the smelting department, the various processes are those of calcining, melting, roasting (so as to obtain the metallic copper free from impurities), refining, and poling, the object of the latter being to convert the blister copper into a marketable product. Mr. J. A.

Phillips, however, has so lucidly and fully described these various operations, together with the extraction of copper of low produce by the wet process,* that I need not dwell further upon them.

Copper smelting is a more unhealthy occupation than iron smelting, owing to the amount of arsenic and sulphurous acid evolved, particularly during the calcining stages; and in this respect Cornish are worse than foreign ores, as they contain more of these impurities. Those who have ever travelled through a copper-smelting district will not easily forget it, for, independently of the peculiarly white appearance of the smoke, so characteristic of copper, the whole neighbourhood feels its effects. For miles around Swansea "the country is entirely denuded of vegetation, while the hill sides have not a blade of grass upon them, but are converted into a mass of detritus of gravel and stone."† Not only are plants and trees scathed and killed by the sulphurous acid, which, the moment that it meets with damp, becomes converted into sulphuric acid, but the very cattle and horses feeding throughout the district are affected with an inflammation of the periosteum, called by the Welsh farmers *effydrdod*, which makes the bones brittle and the teeth to fall out. The late Dr. Thomas Williams computed, that 829,790 cubic feet of sulphurous acid were sent every week into the atmosphere from the copper works on the Tawe. This nuisance was worst during the use of the old form of reverberating furnace; but of late

* 'British Manufacturing Industries.'

† Report of Commission to inquire into Noxious Vapours, 1862.

years, great improvement has been made in the arrangements, by which the sulphurous acid is converted into sulphuric, which is condensed in leaden chambers. Formerly, too, fluor spar was used as a flux; and the effect of this was to disengage fluoric acid, which has the property of dissolving glass, and made all the window panes in the town rough, as though they had been ground. One would have thought that the workers and dwellers in so dense an atmosphere would have been pre-eminently unhealthy, but this is not so. The copper smelters themselves, it is true, suffer much from bronchial affections, and the Registrar-General states that from 20 years and upwards they experience a mortality somewhat above the average, while from 55 to 75 the death-rate is much higher than among the workers of brass and iron. The difference in the rate of mortality is thus put:

	15–	20–	25–	35–
Copper	·451	1·005	1·098	1·422
Iron	·415	·761	·820	1·172
Brass	·380	·679	·872	1·390
	45–	**55–**	**65–**	**75**
Copper	2·017	5·426	11·063	13·043
Iron	2·038	3·903	8·950	23·628
Brass	1·836	3·900	6·938	17·785

The families of copper workers who live in the thick of the smoke are usually healthy and remarkably free from epidemics; and Dr. Williams advanced a theory, that the superior potency of the copper smoke

killed any germs of spreading diseases, and thus obtained for the inhabitants a comparative immunity from them. The occupation in copper mills is much more healthy than in the smelting works, as all the impurities have been pretty well burnt out in the latter. The work is very similar to that of iron mills, and consists principally of rolling into sheets and rods. Boys are employed on the rolls; also in picking up scraps from the shears, and drying the sheets after being "pickled."

The weekly earnings in copper works in Lancashire were:

	1871.	1876.
Labourers	17*s.*	21*s.* to 24*s.*
Furnace-men	30*s.*	28*s.* „ 35*s.*
Hammer-men	25*s.*	..
Rolling men	24*s.*	30*s.* „ 35*s.*
Tube-drawers ..	21*s.*	..
Refiners	..	49*s.* „ 63*s.*
Boys	7*s.* to 10*s.*	..

Furnace-men are paid by the weight per charge, and refining men, by the ton of copper laded.

Our exports for the last five years were:

	Unwrought.	Wrought.	Value.
	cwt.	cwt.	£
1870	213,421	309,861	2,024,151
1871	283,493	247,891	2,092,802
1872	293,604	186,846	2,385,173
1873	259,187	209,448	2,297,313
1874	214,031	211,127	1,997,511
1875	221,794	235,441	2,155,040

In 1875 the exports were:

	Cwt.	Value.
		£
Copper, in ingots or slabs	222,873	980,154
„ coin	1,461	9,349
Yellow metal for sheathing	277,547	1,084,739
Copper, wrought, sundries	233,828	1,163,287

Our chief customers were, for ingots, Germany, France, and Holland; for coin, the Straits Settlements; for yellow metal, India and Italy; and for wrought sundries, Russia and Turkey.

The average price of best-selected copper in the London market for 1874 was 89*l.* 12*s.* per ton.

IV. Lead.

In the lead manufacture (1871) 2874 were employed, of whom 761 were under, and 2113 above twenty years. There were also 546 females, of whom the majority were between fifteen and twenty. The process of lead smelting is carried on very locally and to no great extent in this country, the works being principally found in the vicinity of the mines, as at Alston, in Cumberland (where Mr. Beaumont's mines are situated), on the Tyne westward of Newcastle, Bagillt in Flintshire, Wanlock Head in Lanarkshire, &c. As they are on a much more limited scale than copper works, the injury done to the neighbourhood by destroying vegetation is comparatively slight; but as the same acid (sulphurous) is evolved, it is obvious that the

same elements of mischief are there. Great difficulty has been met with in endeavouring to condense the fumes, although the evils of the lead smoke were mitigated by the introduction of a long chimney, first suggested by Bishop Watson.* Lead smelting, however, is not by any means so injurious a trade as many others in which lead is used as white lead or as a salt, as, for instance, in pottery and painting.

The imports and exports of pig and sheet lead were:

	Imports.	Exports.
	tons.	tons.
1870	58,634	47,802
1871	65,167	44,489
1872	70,069	44,313
1873	60,303	32,010
1874	62,217	36,353
1875	79,829	35,505

and in 1875:

	Tons.	Value.
		£
Lead, pig	24,271	537,562
„ rolled, sheet	11,127	282,541
„ piping and tubing		

Russia took the lion's share of the pig, and Australia of the remainder. Of the imports, most of the ore comes from Italy; of the pig and sheet, from Spain; of the manufactured, from Holland.

* Report of Commission to inquire into Noxious Vapours, 1862.

V. Tin and Tin Plate.

A larger body of operatives is employed in the tin than in the lead manufacture, no less than 6141, of whom 2436 were under, and 3705 above twenty years, together with 932 females, of whom most are between fifteen and twenty years of age. Tin smelting works are almost entirely located in Cornwall, the processes (which have been well described by Mr. Walter Graham in his article on Tin*) consisting of roasting, to free it from sulphur and arsenic (the latter being condensed), washing, reducing into blocks or ingots, and refining for the market. I have not been able to ascertain how many of the numbers given above are employed in smelting; but they cannot form a very large proportion, the remainder being occupied in the preparation of tin for its various applications in manufacture, such as piping, tinfoil, &c., and also in tin-plate works, where the process consists in coating *iron* plates with tin. This, indeed, is one of our most important metal trades, not only employing a great many persons in preparing the plates, but still more, viz.:

	Total.	Under 20.	Above 20.
Males	16,441	3,705	12,736
Females	1,883	1,069	813

in the various crafts coming under the head of tin-plate working. The principal seat of the tin-plate trade (not

* 'British Manufacturing Industries.'

tinplate working) is South Wales and Monmouthshire, and, in a less degree, North Wales, Worcestershire, and Staffordshire, one of the requirements being the proximity of coal and iron. The operations are: placing the iron plates in a bath of muriatic acid, and then in an oven to free them from oxidation, passing them through rollers, and next through a hot bran bath, pickling them in sulphuric acid, scouring, dipping in grease and hot tin, dry branning, rolling with hards, and, finally, sorting and packing in peculiarly shaped boxes holding from 100 to 450. Girls and boys are largely employed in tinning, cleaning with bran, sorting and packing, occupations not involving much physical strength.

The *wages* are usually paid by the box: a skilled workman (1876) generally getting 3*d.*, 3¼*d.*, and 4*d.* per box, on an average production of twenty-five boxes per day.

In 1874 the production was of

Tin and terne plates	1,167,892 boxes.
Black plates	36,684 „

Terne plates are plates coated with a mixture of lead and tin, about two-thirds of the former to one-third of the latter. Black plates are the sheets of iron before they are tinned. Tin plates are usually divided into two qualities, viz. coke and charcoal, the former produced from bar iron made by puddling pig iron in the ordinary puddling furnace, the latter from bar iron made by melting pig in the charcoal fineries.

The greatest proportion of the English make of tin

plates goes to the United States, which took in 1875 90,618 tons.

The exports, principally to the United States, France, and Australia, were :

	Cwts.	Value.
		£
1870	1,997,019	2,362,872
1871	2,392,116	2,900,625
1872	2,364,684	3,812,744
1873	2,412,760	3,953,042
1874	2,459,200	3,714,810
1875	2,771,260	3,691,382

Tin-plate workers are so scattered throughout Great Britain, that they are to be found in every town of any size. At the same time, Birmingham turns out the bulk of the middle-class goods, while Wolverhampton devotes itself to the more expensive styles, and Dudley to the commonest and cheapest. The classes of work are two: 1. the manufacturing; 2. japanning and finishing. The former comprises the operations of working the plates, stamping, spinning, wheeling, and enamelling. The "stamping" is now used for raising articles which were formerly raised by hammers. "Wheeling" is employed in the production of the best turned goods, such as dish-covers, &c. The persons occupied in these processes are nearly all skilled workers, though boys find work as under-hands in making cheaper goods, such as candlesticks. In the latter category, that of japanning and polishing, a large number of women and girls are employed. The work

is not unhealthy, though it is carried on in rooms at a high temperature, for the purpose of drying the varnish as soon as possible, and frequently full of the fumes of spirit, tar, and turpentine. Enamelling, on the other hand, is somewhat injurious, particularly when lead is used as an ingredient.

CHAPTER III.

FINISHED METAL TRADES.

I. Foundries.

I now propose to briefly discuss the industrial phases of those numerous trades which depend for their being upon the supplies of finished metal, whichever it may be. Some of these trades, such as locks, nails, pins, guns, cutlery, &c., are localized to a surprising degree; while others are widely spread over the whole country, and form a link between the essentially manufacturing population and the trading classes. Many an ironmonger in a country town is a manufacturer on a small scale, carrying on a foundry where castings are made, and all those little articles which enter into the wants of an English household. *Iron foundries* are the most numerous, and not a town of any importance but has one, two, or more, in which every kind of work is turned out, from small repairs to castings of large size, such as the girders of an iron bridge. According to the Factories and Workshop Returns of 1871, there were then in England and Wales 1310 foundries, in Scotland 144, and Ireland 64, with a steam-moving power of 22,448, and employing:

	Male.	Female.
Children under 13	238	11
Between 13 and 18	14,086	2,734
Above 18	62,610	
	76,934	2,745

Birmingham contains a greater number and variety of foundries than any other town, and to show how diverse are their products, I will instance the Soho Foundry, a very old and typical establishment, founded 1707 by the celebrated firm of Boulton and Watt. From hence issue marine and land boilers, mill gearing, sugar mills, coining machinery, apparatus for sewage works, and all kinds of heavy undertakings. When we turn to Manchester, we again find enormous foundries, though the character of the work is different, for here, in obedience to the demand of the staple textile industries, is produced the requisite machinery for spinning and weaving mills. In these machine works, engineering and iron-founding meet on neutral ground.

The classes of operatives differ according to the character of the work executed in each foundry: but there are certain stock workmen, who are necessarily associated with this occupation (see p. 116). The average earnings (1871) were:

Angle-iron smiths	5*s.* 8*d.* per day.
Boiler makers	5*s.* 4*d.* „
Engine erectors	5*s.* 4*d.* „
„ fitters	5*s.* „

Millwrights	5*s.*	per day.
Iron-moulders	5*s.* 8*d.*	„
Loam-moulders	6*s.*	„
Core-makers	3*s.* 8*d.*	„
Labourers	3*s.*	„
Smiths	5*s.*	„
Strikers	2*s.* 10*d.*	„
Furnace-men	4*s.* 4*d.*	„

Iron foundries come under the Factory Extension Act of 1867, except in cases where not more than five persons are employed, these latter being under the Workshops Act. The hours of labour are fifty-four per week, viz. nine hours a day, from 6 A.M. to 5 P.M. Boys may be employed as half-timers at nine years old, but not at night under thirteen. Women occasionally find occupation as makers of cores, which are pieces of well-baked sand, for the purpose of filling up the holes or hollows in castings. It was incidentally mentioned by a witness before the Factory Commission of 1875, that many very young children were in the habit of collecting horse-dung in the streets and roads to be used in moulding.*

Brass-founding and brass-work generally, give employment to a large body, viz. 20,983 males and 3905 females (1871), including lacquerers, burnishers, and others in the trade. The respective ages of the males were:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
9	1530	4276	3444	4964	3045	2009	1162	432	112

* Report of Commissioners to inquire into the Factory and Workshops Act, 1875.

which shows how large a proportion consists of young lads. Among the females, too, the same characteristic of juvenile labour is observed. Probably there is no trade so comprehensive as that of the braziers, or one which includes so many subsidiary occupations, such as brass-founding, cabinet, bell, and general brass-foundry, plumbers' and stamped brass-foundry, rolled brass, wire, sheathing, tubes, lamps, gas-fitting, &c., in an almost endless catalogue of articles. It would be impossible in the limited space at my command to enter into all these subdivisions of labour; nor, indeed, would it be necessary, for they are all subject to the same sanitary and social conditions, and my object is to show how the main groups of industries are affected by these conditions.

The chief process in ordinary brass casting consists in melting the metals, copper, zinc, lead, or whatever they may be, in a specially prepared crucible, and pouring them into moulds or ingots. This is the most unhealthy stage of brass-founding. Fumes of oxide of zinc are given off, filling the atmosphere with a fine white powder, and producing what is known in the trade as "brass ague." Dr. Richardson says, that these fumes give rise to choleraic disease, severe cramps, and sickness;* and all these symptoms are naturally aggravated, when the casting-house is small and ill-ventilated, which it too often is. As a rule, brass casters seldom last longer than between forty and fifty. If the caster is a prudent man, he ties a handkerchief over his mouth and nose, and thus saves himself as much as possible from contact with the zinc. Boys are employed in the

* 'Society of Arts Journal,' 1876.

casters' shops, being usually hired and paid by the caster; but they are in larger numbers in the finishing shops, where they file brass (not the most wholesome occupation), and do other odd jobs. The women work at lacquering, burnishing, polishing, and wrapping up; and, of late, an opening has been found for them in turning the brass in a lathe. The average weekly earnings are:

Casters	40*s.*
Moulders	36*s.* to 40*s.*
Fitters	26*s.* „ 32*s.*
Chasers	30*s.* „ 40*s.*
Millers and drawers	30*s.* „ 45*s.*
Pattern makers	30*s.* „ 100*s.*
Modellers	
Designers	
Labourers	18*s.*

"Bronzing and lacquering, or dipping and lacquering, are usually charged at about 6*d.* per square foot of surface; burnishing, by time."

The Registrar-General's Report for 1871 states that 267 males occupied in the brass trade died during that year, viz.:

10–	15–	20–	25–	35–	45–	55–	65–	75
1	20	30	44	46	45	37	29	15

But on referring to the comparative table (p. 58), it will be seen that the brass manufacture is healthier

than that of iron, save between twenty-five and forty-five, when the mortality is rather in excess.

The exports of brass for the last five years (not including ordnance) were:

	Cwt.	Value.
		£
1870	57,466	247,075
1871	70,816	319,268
1872	69,100	377,355
1873	83,548	500,720
1874	104,760	659,975
1875	91,093	492,869

Our principal customers are Germany and Holland.

II. Nails and Chains.

The next division of labour to which I shall refer, is not only very important numerically, but has been the subject of considerable attention of late at the hands of the factory inspectors and the public generally. It is that of the nail and chain trades, the area of which, though limited, is filled to overflowing with operatives, and contains more typical characteristics (though unhappily not of an enviable kind) than any other trade in Great Britain. According to the Census, the numbers of these workpeople were:

	Males.	Females.
Nails	12,367	10,864
Chains	4,163	910

and the respective ages (of the nailers):

	5–	10–	15–	20–	25–
Males	28	1076	1420	1225	2156
Females ..	32	1176	2445	1740	2048

	35–	45–	55–	65–	75
Males	2115	1847	1425	793	282
Females ..	1446	1055	583	261	78

There is certainly no trade (except textiles) which shows such a preponderance of female labour—the more surprising, as the work is not one that is suitable for women. Herein lies the secret of the disgraceful social conditions, which prevail in that section of the Black country where nailers congregate. One would naturally have thought that a nail trade would be found, wherever there was coal and iron; but it is not so. It is limited to that portion of the South Staffordshire and Worcestershire coalfield which borders Stourbridge, Dudley, Cradley, the Lye, Rowley, and Halesowen, while a smaller detachment is found near Bromsgrove, and also at Belper, in Derbyshire. Everything in the former district, which naturally abounds in scenic beauty, is devoted to nail making, the villages, which are all continuous, being full of little nail and chain shops, so full, that the Sub-inspector of Factories, in his report for 1874, says, that whilst he had visited 2000, he had not then, within his year of office, though residing among them, seen one-fourth of them. "These shops are not only side by side for streets together, but

hearths are also in the houses of the people, and the hammers are clinking hour by hour with scarcely any intermission. Men or women are masters or mistresses of the shops. The men manufacture the heavier, and the women the lighter chains, whilst the children are the bellows blowers. . . . . The workers are divided into three classes, viz. the 'hundreds,' i. e. those who are making the large class of nails or spikes; the 'thousands,' those who make the smaller class, which two bodies were once united in order to ameliorate their position, but are now separated; and the horse-nail makers, who stand aloof from both, and form a separate branch of the trade. The peculiarity of the horse-nailers is, that they have kept out of their branch all women, with one solitary exception."* The late Mr. Aitken, in his interesting article on Nails,† tells us of the numbers and varieties which are made—rose, clasp, Flemish, clout, sacking, slute, tray, saddle, brads, Kent and Essex hurdle, gate, pipe, plate, scupper, mop, hob, sparrables, tips, clenchers, tenter-hooks, &c.

The great evil of the trade appears to be the "middleman," or "fogger" system, the nailers rarely working for themselves, but for the "nail master," who opens warehouses in the various districts, and gives out, on certain days, nail rods to be worked up during the week. At the end of the week the nailer brings back the made-up nails, and is then paid either in money or goods, the "fogger" taking care to practise truck as much as he dare. "Individually, the work is carried on in small shops with from two to ten

* Factory Reports, 1872–75.

† 'British Manufacturing Industries.'

hearths each, and these are to be met with behind almost every cottage. Each hand hires his or her own hearth or 'standing,' and is in no way responsible to anyone, provided the rent is paid." Here, then, is one circumstance which makes nailing so unlike other trades, that in consequence of the operatives being all out-workers, no control can be exercised by the masters. Another is, that women are so largely employed in the trade. The process certainly is simple enough, but it is one in which Vulcan would never have allowed Venus to share. A pair of bellows, anvils, hammer, a "bolster" through which to drop the prolonged spike, or an "oliver," a kind of heavy hammer worked by a treadle, form the plant. In chain making, the oliver is used for welding the links together, and its weight is in proportion to the size of the links. There really appears to be no reason why women should have been so largely brought up to the nail trade; but it was so, a hundred and forty years ago, when Hutton made his journey northwards, and therefore tradition and custom have perpetuated a very undesirable state of things. The worst part of the system seems to be, that the women are really doing the work of men, while the men themselves are practically living a life of idleness, often avowedly marrying a wife who is a clever nailer, in order that she might maintain him in his drunkenness and profligacy. When the men *do* work, it is by fits and starts, the first half of the week being generally wasted in holiday making. Another great evil is the middleman, who is the godfather of the improvident, viz. seven-tenths of the whole population,

buying the nails at a cheap rate from the workmen, selling them at an advance to the nail masters, and taking every advantage that he can, in the way of small cheatings. In a district characterized by such industrial features, it is no wonder that the inhabitants are rough and ill-mannered, and that sanitary and educational improvement is as yet at a very low ebb. To supervise the working of the Workshops Act here is a heavy and dispiriting task, although it is satisfactory to know that even so far, decided benefit has accrued.

Another marked feature in the trade is the extensive employment of juvenile labour. Children, frequently very young ones, are the bellows blowers of the family hearth, and although for the first half of the week, when the father is idle, there is a corresponding idleness for the child, for the remainder of the week he has to work without ceasing from early morning until late at night, in fact as long as the nailer himself works, producing not only physical but mental deterioration. This evil, however, is being gradually dealt with under the firm hand of inspection.

Looking at the nail and chain trade in a sanitary point of view, there is nothing in it to make it unhealthy, save the uncleanly habits of the workers and the prevailing drunkenness. The deaths in the Registrar-General's tables for 1871 were as follows:

	Total.	10–	15–	20–	25–	35–	45–	55–	65–	75
Nails	273	2	5	7	13	28	40	53	72	53
Chains	75	1	1	5	7	9	16	13	19	4

The wages of these districts are very fluctuating, depending as they do on so many causes; such as the state of the iron and coal trades, the price of materials, i.e. rod iron for the nail making, and "breeze" for the firing, the irregular hours of work, and the dishonesty of the middlemen. A woman (in 1875) working ten hours a day gets about 8*s*., though if she had taken the work to an honest master, she would perhaps have received 12*s*. Out of this she has to pay 2*s*. for "breeze," and 1*s*. for the hire of the stall, with perhaps 1*s*. 6*d*. for a nurse for her baby. On the other hand, a good anchor maker (male) can make 50*s*. to 60*s*. per week. As a rule, it may be stated that nail makers earn from 12*s*. to 16*s*. per week, women 6*s*. to 8*s*., children 3*s*. to 5*s*. That the latter deserve their earnings is shown by a remark of Mr. Aitken, "that at the age of ten or twelve they are expected to make their 'stint' of 1000 nails per day."

Hitherto I have been speaking of the hand-wrought nail maker. The introduction of machinery has dealt the heaviest blow that the trade could possibly have received, and as cut nails are rapidly increasing in demand, it is probable that the hand trade will gradually dwindle away. The great difference between the two, in an industrial point of view, is that the cut or patent nail trade is a factory system under strict control, and consequently assumes a very superior aspect in all points. The operations carried on are partly those of an iron rolling mill, with special machines for cutting the nails, but as they have been so well described by Mr. Aitken, I need not refer to them now. Wolverhampton,

the Dôs works at Newport (Mon.), Leeds, and Newcastle are the principal seats of this trade at present, although doubtless other cut-nail factories will soon spring up. The wages are for

Machine superintendents ..	25*s.* to 55*s.* per week.
Ordinary workmen	17*s.* „ 25*s.* „
Women and girls	7*s.* 6*d.* to 15*s.* „

In 1875, 17,106 tons of nails, screws, and rivets were exported, of the value of 528,321*l.*, the principal purchasers being Australia, Bengal, British North America, and the West Indies.

III. Locks.

The locksmith's trade is even more localized than the nailer's, for it is almost entirely confined to South Staffordshire, in the neighbourhoods of Wolverhampton, Willenhall, Walsall, and Wednesfield, where it has flourished since the seventeenth century. The Census tables give the numbers (including bell hanging) as 7154, of whom at least 5000 are to be found in the district named. The ages were:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
8	482	1100	945	1504	1072	949	637	317	130

In 1841 the numbers in this trade were 5521; in 1851, 6423; in 1871, 7154.

The localization of the trade, as a trade, is singu-

larly carried out, even to the minute subdivisions of the manufacture; for, as Mr. Aitken tells us,* "Wolverhampton is celebrated for its tin, cabinet, levered rim, mortise, and fine plates; Willenhall for warded rim, dead, drawback, and pad; Walsall and Bloxwich for iron pad and cabinet; Brewood for its fine plate." Probably there is no trade in England which shows such curious arrangements.

Like nail making, the lock manufacture is not carried on very much in factories, but more commonly is in the hands of a number of "little masters," who have scarcely any capital, and make locks from hand to mouth. The apprentice system, which was formerly much acted on in the trade, has been rather dying out of late years, although juvenile labour is still much in request. Children are occupied in blowing bellows, filing locks, and drilling the pipes of keys. There is nothing necessarily unhealthy in this employment, except that the metal has to be placed in a vice, which is usually too high for the children to work at, except by standing on some pedestal. This constrained attitude (and doubtless the long hours of work prevalent in these days) was shown by Mr. Horne to lead to displacement of the right shoulder-blade, and the bending of the right leg inwards towards the knee. Most of the "little masters" employ some six or eight men and boys, the latter earning from 2*s.* 6*d.* to 3*s.* 6*d.* per week. The lock trade has been hitherto looked upon as a badly paid one, arising, no doubt, from the im-

* 'British Manufacturing Industries.'

mense competition and the ridiculously low prices at which some of the commonest locks can be made, viz. 6½*d.* per dozen. The small masters obtain what they can from the lock factors, and pay various sums to the helps. Journeymen in Wolverhampton and Willenhall get the highest wage, viz. 25*s.* to 40*s.*, the best locks being made in these localities, and the greatest number of employers and employed being at Willenhall. In Walsall and Bloxwich wages average 18*s.* to 30*s.*; in Wednesfield, 15*s.* to 25*s.*; in Brewood (where plate locks are made), 18*s.* to 28*s.* The females engaged in the lock trade are few in number, and are principally employed in wrapping up. Indoor apprentices have no wages, but are allowed by their masters to earn one or two shillings a week by working over the regular "stint." In lock factories, where skilled labour is in request, the wages are much higher, and are given in the Factory Returns for 1871 as follows:

Fitters	30*s.* to 70*s.*
First-class mechanics	42*s.* „ 55*s.*
Labourers	18*s.* „ 35*s.*
Boys and youths	6*s.* „ 13*s.*
Women working automatic machines	9*s.* „ 13*s.*

This table is quoted as an exceptional case.

It is satisfactory to learn that locksmiths are far above nailers, and indeed above many of the Black-country operatives, in physical and moral improvement. It is mentioned by Mr. Tyldesley (writing in 1866) that "in one lock factory, which may be taken as a fair

example of the others in the district, 70 per cent. of the artisans are members of friendly societies, 50 per cent. can read and write, 15 per cent. are members of a mechanics' institute, 10 per cent. have accounts with the post-office savings bank, and 5 per cent. are owners of the freehold cottages in which they live."

IV. Cutlery.

In whatever light our cutlery manufactures are regarded, whether from their extent, variety, and importance, or the immense numbers of people engaged in the trade, there is a deep interest attached to the subject. Next to that of iron and steel, which of course is its basis and intimately connected with it, it is the staple trade of the very large population which inhabits Sheffield and a considerable area around it, extending even into Derbyshire; and though cutlery, strictly speaking, forms only an integral portion of the occupations, I shall group with it the kindred trades of file, saw, tool, fork, and scissors grinding. The numbers engaged in these trades were (1871):

	Male.	Female.
Cutlery	17,066	837
Tools	7,453	174
Files	7,980	1,021
Saws	1,930	
Scissors	1,065	376
Surgical instruments ..	1,004	
	36,498	2,408

The ages of the male workers were as follows:

	5–	10–	15–	20–	25–	35–	45–	55–	65–	75–
Cutlery	7	804	2521	2263	4197	2887	2414	1238	596	109
Tools..	..	254	1082	1156	1874	1376	914	532	220	45
Files	2	449	1324	1218	2073	1322	978	417	154	43
Saws	..	52	231	249	489	370	289	159	75	16
Scissors	..	48	130	122	260	198	168	96	37	6
Surgical instruments	..	25	156	153	259	175	127	68	33	8

The Factory Returns of 1871 show, how Sheffield absorbs the major part of this population.

	No. of Works.	No. of Children under 13.	Up to 18.		Males above 18.	Total.	
			Male.	Female.		Male.	Female.
Cutlery	396	..	1265	1079	5950	7328	1092
Files, saws, and tools	261	126	881	780	5220	6126	782
Sundry metal..	223	131	635	106	3662	4424	110
						17878	1984

This of course is but a small portion of the borough of Sheffield population, which in 1875 had amounted to 267,881 persons. Nor does the previous table imply that there are no other main industries, for, as we have seen, Sheffield is the principal head-quarters of the steel trade, to which must be added blast furnaces, foundries, machine shops, brass finishing, Britannia metal and electroplate, crinoline making, besides the numerous trades which go to make up a large town. We must also remember that the borough boundaries do not take in the extensive country districts around, where indeed the greater part of the work, as regards grinding, is carried on, partly, as we shall see, from

economy of rent, and partly from facilities of water-power. I will first of all deal with the grinders, their respective occupations being again subdivided into the grinding of forks, spring knives, razors, scissors, table knives, edge tools, saws, surgical instruments, files, and sickles. All these are distinct branches, although they are all more or less characterized by the same sanitary and physical conditions.

Cutlery, in Sheffield *parlance*, means the handling, making up, and finishing the knives, razors, scissors, &c., in bone, ivory, and wood.

Grinding, whatever may be the class, is carried on usually in premises called "wheels," exclusively devoted to it, although it is also found in factories where other processes are performed. The wheels may be public, i. e. let out by various owners to grinders who pay rent; or private, on the premises of the manufacturer, who sublets them to his own workmen. The wheel is divided into "hulls" or workrooms; each of which, in its turn, contains so many "troughs" or individual workplaces. The process of grinding may be defined as the shaping of the metal, by cutting it on a revolving stone, and for this purpose the workman sits on a broad horsing, the wheel revolving in front of him, so that he has to curve his body forward, with his head downwards. There are also "smoothing" operations, such as glazing on a wheel covered with emery, or polishing on a wheel with crocus powder, all of which are carried on in the same work-place. The mill-stone revolves at great speed by steam power, and is a frequent source of accident, for it sometimes flies,

owing to a flaw in it or the too great velocity of the speed, especially if the stone happens to be fixed on its axle in a careless manner, as is not unfrequently the case. When such an accident happens, the risk of the grinder being struck is very great. This, however, is fortuitous, and can be guarded against; but the most common evil to which the grinder is subject, is the inhalation of the dust produced in the work, and which, in past years and even now, is so productive of respiratory mischief, that it is familiarly known as "grinder's disease" or "grinder's rot." Workmen in the crowded town are more liable to this, than those who work their wheels in the picturesque dingles and river valleys for which the neighbourhood of Sheffield is famous, for the reason that, room being valuable, the wheels are smaller and worse ventilated than those in the country. The consequences of this disease used to be very serious, for grinders seldom lived above forty, and many began to go off work as early as twenty-five. Thirty years ago it was ascertained that amongst the razor-grinders, 749 out of 1000 died under forty years; and in 1857 a table was drawn up by Dr. Hall, which showed that the average age at death of fork grinders was:

In 1836	42	1844	41
1840	40	1845	38½

There are two kinds of grinding, wet and dry; the former of which, as is natural, is far more healthy than the latter. Unhappily, it is only one section of the trade, viz. the file cutters who use wet grinding.

Fork grinding is generally considered the most unhealthy of all; and no wonder, when we are told "that forks of average kind lose about one-fourth of their weight, all in dry dust. A dozen razors of two kinds are respectively reduced by dry grinding from 2 lb. to 1 lb. 10 oz., and from 2 lb. 4 oz. to 1 lb. 15 oz. The dust of metal, i.e. cast iron, used for cheap forks and scissors, is usually considered more pernicious than that of steel." * File cutting has another evil besides the stooping position, viz. the absorption into the system of the lead upon which the file is cut, which produces lead poisoning and colic.

With a trade presenting such notoriously unhealthy aspects, it was natural that much attention should have been directed towards the alleviation of its ills, and several inquiries have been held to that effect at different times, such as those of Mr. Jelinger Symons in 1841, Dr. Greenhow in 1860, and the Children's Employment Commission in 1865. Dr. Greenhow showed not only the dangers of inhalation during grinding, but pointed out an additional source of danger when the stone was being "razed," an operation which consists in bringing the fresh stone into shape, while revolving, by means of a bar of steel. "Hacking," also, or roughing the surface with a pickaxe, also produces great clouds of dust of a peculiarly irritating nature. For years, various employers have advocated and tried the use of a fan, by which a strong ventilating current was caused, and the greater part of the steel and stone dust blown away, instead of going down

* Children's Employment Commission, Fourth Report, 1865.

the grinder's throat. One would have thought that the workmen would have welcomed such an obvious benefit; but, on the contrary, it met with the very greatest opposition, partly on the score that the fan would entail some expense (though very slight) in putting up, and partly from the very conservative objection to anything new, the men alleging that they were used to dying early, and that if the habit of long life was encouraged, the grinder's trade would be ruined! It can scarcely be imagined that such arguments could seriously be advanced in the latter part of the nineteenth century; but so it was; and even now, although public opinion has gradually converted the trade to using the fan, there are still wheels to be found destitute of this very necessary improvement.

Children and females are both employed in considerable numbers in some of the lighter work, and particularly in cutlery, such as spring-knife cutlery and table-knife hafting. The system of apprenticeship, which was formerly very common, has declined of late years, as has also the practice of over-work, thanks to the Workshops Act, which took cognizance of a vast number of small places of work. Previous to this, twelve to fourteen or sixteen hours per day was a common thing, and especially on occasions like the "Bull week," before Christmas, when everybody was considered licensed to labour an indefinite period at a time, so as to obtain money for the festivities of the season. Boys work a good deal at file cutting, which involves long-continued exertion. "The data given by one

man, assuming them to be correct, show that in a day of ten good working hours, he numbers 46,000 strokes, most of them with a 7½ lb. hammer, thus lifting a weight of 142 tons. Boys use lighter hammers, usually from ¼ lb. to 3 lb."

Even now, though matters are very greatly improved, Dr. Griffith, the medical officer of health for Sheffield, informs us "that the bulk of deaths referred to local diseases result from diseases of the respiratory organs;"* and the Registrar-General (1875) says that "tool, file, and saw makers have among them the grinders, who suffer so much from sharp particles of stone and steel inhaled into the lungs; their mortality is thus high, and at the ages of forty-five to sixty-five excessive."

Table of the mortality of males (1871):

	Total.	5–	10–	15–	20–	25–	35–	45–	55–	65–	75–
Tool makers	128	..	1	5	7	23	15	20	31	13	13
File makers	170	..	..	9	11	36	29	29	27	18	11
Saw makers	39	..	..	2	3	9	5	5	6	8	1
Cutlers	253	..	1	8	16	30	25	61	51	41	21
Scissors makers ..	25	..	..	1	2	3	4	2	5	5	3

The percentage of mortality in these trades, compared with "all classes," is as follows:

	15–	20–	25–	35–
All classes ..	·632	·859	·985	1·305
Cutlery trades	·452	·814	1·136	1·495

* Report, 1875.

	45–	55–	65–	75
All classes ..	1·853	3·215	6·676	16·584
Cutlery trades	2·680	5·033	7·935	20·635

By the Factory Extension Act of 1867, and the Workshops Act 1867, special clauses were inserted, as to the compulsory adoption of a fan, should the inspector see fit, in every factory or workshop where grinding, glazing, or polishing on a wheel went on, so that the young at all events are now saved from this terrible tax upon health.

The following are the ordinary (and very fluctuating) rates of weekly wages in these trades:

	1871.	1876.
Edge tools—		
Forgers	45*s.*	40*s.*
Strikers	20*s.* to 25*s.*	30*s.*
Grinders, with apprentice ..	55*s.* „ 60*s.*	38*s.*
„ single	45*s.*	
Hardeners	28*s.*	28*s.*
Files—		
Forgers	55*s.*	30*s.* to 90*s.*
Strikers	25*s.*	20*s.* „ 65*s.*
Forgers, single-handed	40*s.*	
Cutlers	30*s.*	20*s.* „ 60*s.*
Hardeners	34*s.*	25*s.* „ 35*s.*
Scourers	10*s.*	9*s.* „ 18*s.*
Grinders	40*s.*	20*s.* „ 100*s.*
Cutlery—		
Spring-knife cutlers	26*s.*	20*s.* „ 40*s.*
Pen and pocket-blade grinders	30*s.* „ 32*s.*	20*s.* „ 40*s.*
„ „ forgers ..	30*s.* „ 35*s.*	
Table-knife cutlers	28*s.*	16*s.* „ 35*s.*
„ grinders	30*s.* „ 60*s.*	16*s.* „ 35*s.*
„ forgers	30*s.* „ 50*s.*	25*s.* „ 40*s.*

	1871.	1876.
Razors—		
Razor cutlers	28*s.*	
„ grinders	25*s.* to 35*s.*	
„ forgers	30*s.*	30*s.*
Scissors—		
Forgers	20*s.* „ 32*s.*	50*s.*
Filers	25*s.* „ 35*s.*	20*s.* to 40*s.*
Borers and finishers	25*s.* „ 35*s.*	25*s.* „ 35*s.*
Grinders (glazing)	27*s.* „ 40*s.*	40*s.* „ 70*s.*
„ (polishing)	30*s.* „ 48*s.*	
Dressers (women)	7*s.* „ 14*s.*	8*s.* „ 12*s.*
Burnishers (women)	7*s.* „ 12*s.*	8*s.* „ 14*s.*
Saws—		
Saw makers (day)	28*s.* „ 33*s.*	
„ (piece)	25*s.* „ 50*s.*	
„ grinders	40*s.* „ 60*s.*	
„ handle makers	20*s.* „ 30*s.*	
„ scourers (women)	9*s.* „ 12*s.*	
Warehouse-women	9*s.* „ 12*s.*	

It should be mentioned that grinders have to find stones and tools, or else to pay rent for their "hull," which will have to be deducted from the earnings, leaving from 45*s.* to 60*s.* Scourers and dressers are all young females, and are occupied in scouring the goods with sand-paper.

When we come to look at Sheffield as the home of all these operators, we shall find that it is neither better nor worse than most of our large manufacturing towns. The visitor who sees the inhabitants after working hours will not be very favourably impressed, for the occupations being dirty and not over healthy ones for the most part, stamp themselves abundantly on the countenances and persons of the workers. Mr. Mundella, M.P., drew attention, too, to the great number

of dwarfed and crookbacked persons, arising from the confined and cramped positions in which so many of them do their day's labour. The dwellings of the poor are many of them very wretched, but an energetic Board of Health is fast improving them; and the town itself is being gradually beautified with many handsome public buildings. The United States consul, in a communication to his Government,* mentioned that the two besetting sins of the town were drunkenness and gambling, and Mr. Callis, in his article on Cutlery,† corroborates these unenviable traits in the Sheffield workmen.

As regards trade societies, the following are the principal:

	Members.
Filesmiths' Union .. .. numbers	3000
Edgetool and Woolshear Grinders' Society „	250
Razor-blade Grinders .. .. „	200
Scissors Grinders .. .. „	200
Sheffield File-grinders .. .. „	300

I will only very briefly allude to the memorable notoriety which Sheffield obtained some years ago in connection with trade outrages and "rattenings," of which the latter appears to be a mild form, and to be not unknown even at the present day. No right-minded person can ever wish the perpetuation of terrorism such as this; and it is to be hoped that, as time goes on, it will be looked upon in its true light, and held in abhorrence by every decent working man.

It is a fact pregnant with importance, that more

* Labour in Europe and America, 1875.
† 'British Manufacturing Industries.'

than one Sheffield manufacturer has betaken himself, with his knowledge, ideas, and energies, to America, where he can obtain a field for his labours unfettered by those perpetual trade differences which are threatening to ruin English commerce; and if this emigration continues, Sheffield will no longer keep her place as the mistress of the cutlery trade.

The following table shows the value of cutlery and hardware exported since 1867:

	£		£
*1867	480,370	1872	5,088,764
*1868	439,688	1873	4,938,537
*1869	497,427	1874	4,403,399
1870	3,812,385	1875	4,265,451
1871	4,006,385		

* Cutlery alone; after 1869 it was grouped with hardware in the returns.

The chief consumers in 1875 were, arranged according to order, Australia, America, Brazil, Germany, West Indies, South Africa, Chili, Argentine Republic.

V. Pins and Needles.

Needles employ a far larger number of people than do pins. The proportions to each trade were as follows:

	Males.	Females.	Total.
Pins	284	403	687
Needles	2629	2110	4739

and the respective ages:

	5–	10–	15–	20–	25–
Pins	2	129	154	98	106
Needles ..	22	506	916	735	797
	35–	**45–**	**55–**	**65–**	**75**
Pins	70	60	45	15	9
Needles ..	560	341	265	86	34

The localization of these two trades is very marked. Pin factories are found principally at Birmingham, and also at Dublin, Stroud, Warrington, Bristol, and Redditch, while the chief seat of the needle trade is Redditch, though Sheffield and Hathersage in Derbyshire also claim a share in the manufacture. Formerly a much larger number were employed in pin making than at present, for previous to 1824, it took fourteen persons to make a pin; but by the production of the Wright pin machine in that year, the services of all but two or three were dispensed with, for this machine produced a perfect pin; and even the pointing, which was formerly done by hand, is now mechanically performed. Children are occupied principally in sticking and sorting the pins, or looking after "the shaking barrel," i. e. the machine in which the pins are shaken. This is not a very healthy occupation, as the metal dust from them is apt to be inhaled, but in general there is a great improvement in the pin-making occupations. In the old

pointing by hand, a great deal of dust was given off, but by the new method, it is caught in a box. It is extraordinary how simplified the process of pin making has become, one woman or girl being able to superintend at least four of the machines, while even sticking the pins in rows into cards is done by a machine.

In needle grinding, a very considerable quantity of steel dust and sparks is given off, and this, if allowed to be inhaled, is productive of very bad effects. Excellent means have, however, been adopted of late years to obviate this; one plan, used at Hathersage, being to cover the top of the stone with a damp cloth, leaving only the few inches uncovered which the grinders require, while, at the back of the stone, a wide-mouthed pipe at the top carries off most of the dust, which is sucked in by a powerful fan. The benefit rising to the grinders from this is enormous, and they are now as healthy as any other class of workmen, and, moreover, are so persuaded of the value of the fan, that they will not work unless it is in use. It may be mentioned that Hathersage is also the seat of the "hackle pin" trade, these being sharp steel wires used for combing flax. They are made precisely in the same way as needles. Redditch is, of course, the great emporium, not only of needles, but of fishing hooks and all sorts of tackle. A curious instance is mentioned in Mr. Timmins' book on Birmingham trades,* of the opposition to improvement, in the case of a Redditch manufacturer, who in 1840

* 'Birmingham and the Midland Hardware Districts.'

revived the practice of hardening the needles in oil instead of water, the effect being to prevent the needles becoming crooked. The operatives, however, became so alarmed at the prospect of needles being made which would last, that they mobbed the unfortunate man and drove him out of the place.

Whereas pins can be made by one or two hands, needles have to pass through about seventy, an instructive example of subdivision of labour.

The wages vary from 12*s.* to 40*s.* per week for men, 8*s.* to 15*s.* for women, and 1*s.* 6*d.* to 5*s.* for children. The latter are largely employed in hand work, viz. passing wires through the eyes of the needles, so as to facilitate the filing. The Redditch operatives are socially superior to those of other towns, and the factories are in general well looked after in all sanitary and intellectual matters. But although the factories in the Redditch district are well arranged, there are a great number of small workshops where the ventilation is very bad, and the hours prescribed by the Factory Laws do not appear to be so strictly observed. The occupation, however, cannot now be an unhealthy one, as is proved by the Registrar-General's Returns for 1871, which gave as follows:

	Total.	15–	20–	25–	35–	45–	55–	65–	75
Needles	44	3	4	3	7	4	11	4	8
Pins	7	1	..	1	2	..	1	2	

VI. Buttons.

Button makers form rather a numerous branch of operatives, of whom the greater number are to be found in Birmingham. In 1871 there were: males, 2372; females, 3439; total, 5811.

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
15	737	1236	861	1072	833	633	284	119	21

And it will be seen, that a very large proportion consists of young children, mostly girls. The returns of the button factories in 1871 are given as:

	No.	Under 13.		Up to 18.	
		Male.	Female.	Male.	Female.
Warwick ..	20	20	58	147	2317
York	1	..	2	6	24

Since 1841 the female element has gradually superseded male labour, as shown thus:

	Males.	Females.	Total.
1841	2308	1647	3955
1851	3045	3945	6996
1861	2819	3825	6644
1871	2372	3439	5811

An estimate was made in 1865, by Mr. Turner, of the numbers engaged in the button trade of Birmingham, viz.:

Metal buttons of all kinds	1200
Covered buttons (including linen) ..	1500
Pearl buttons	2000
Vegetable ivory buttons	700
Glass, bone, wood, &c.	600
Total	6000

Mr. Aitken, in his article on Buttons,* shows what an immense variety are made, and the different materials which are used in the manufacture. Hand work is very largely employed, and the greater portion of this being of simple character, enables so much juvenile labour to find a market. The employment, however, is in many cases not so healthy as it might be, partly arising from the little capital required, and the consequent number of "small masters" in the trade, and partly from the specific nature of the work. The different kinds of buttons are so numerous, that they cannot be classified, except that the pearl and glass buttons form a separate and distinct branch. Much of the work is done by women, who sit as close as they can together to work the "presses," while facing them in rows are the children, who "put in" buttons to the press for them. As the shop is generally heated by steam-pipes and there is a good deal of gaslight, the atmosphere is far from fresh, and there is much noise and vibration from the presses. In addition to minding

* 'British Manufacturing Industries.'

the machines, the women are occupied in picking out waste, sewing buttons on cards, &c., while the boys are employed in cracking the ivory nuts of which the buttons are made, while others "cob" for the men who stamp. They also prepare and place the work for the men; and sometimes turn light wheels, or superintend punches or small saws. In some of the factories where bone or horn buttons are made, the bone is boiled, and causes a very unpleasant smell from that, and the refuse that is always lying about. The men are principally occupied in tool making, in "setting" tools for the females at work at the presses, in cutting the vegetable ivory and bone with circular saws, and afterwards turning it; while the women drill and polish, and the girls card. The button trade, however, especially in bone and pearl, has greatly declined since the American War, and the numbers of the workers have diminished at least one-half. The pearl button trade is curiously distinct from the others, and has its separate employments and its separate organization for trade purposes. The manipulation is almost entirely done by hand, for the brittle nature of the material does not allow of a faster rate of working than a foot-lathe will accomplish. The processes are: 1st, cutting out the pearl from the shell with a circular saw by the "piece maker;" 2nd, turning; 3rd, drilling, polishing, and making fancy edges by the women, while the small children card. The rate of pay for the men is about 2*d.* per gross of one hundred and fifty, six pieces

being made over, to allow for breakage. Boys are paid ½*d.* a gross for filing. The dust that is given off in pearl button making is very considerable, and not only induces by inhalation a tendency to respiratory disease and *phthisis*, but, according to German scientific observers, a special kind of bone inflammation, or *osteitis*, which attacks the thighs and arms. The japan button trade is different, and the work here consists in cutting out, drawing through, putting shanks in, and closing, all this being done by presses. The japanning is dirty work, but otherwise harmless. In the glass buttons, the glass is clipped off with scissors by young children, known as "nippers," ground on a grindstone by an adult, and then cut into facets on a small wheel, after which it is polished.

The wages earned bear a relation to the importance and skill required in executing the various processes. Tool makers are highly paid. Button-making men average 25*s.* per week.

Wages are usually paid by piecework; and in the covered button trade, working from 8 A.M. till 6 P.M., an average woman can earn 8*s.* to 10*s.* a week, while the more skilful make 14*s.* to 20*s.*; children, 1*s.* 6*d.* to 2*s.*

The mortality of button makers (1871) is as follows (males only):

Total.	20–	25–	35–	45–	55–	65–	75
62	1	3	13	19	17	4	5

The exports of buttons are included in those of hardwares generally; but it may be mentioned that of buttons and studs, not of metal, we imported in 1874 and 1875:

	Value.	
	1874.	1875.
	£	£
Germany	127,122	86,073
Holland	72,924	69,511
Belgium	48,017	36,351
France	112,727	139,515
Other Countries ..	120	921
Total	360,900	332,371

VII. Firearms.

The manufacture of guns shows, almost more than any other trade, a very marked change in its circumstances. Not so many years ago, according to Mr. Aitken,* the production of a gun was distributed over fifty individuals; but to a great extent this has been altered by the introduction of automatic machinery, by which all the various and complicated parts of a gun are rendered interchangeable; and, in some degree, has dispensed with many of the workpeople who found their living in this trade. The Factory Returns for 1871 give the following list of gun-making factories in this country:

* 'British Manufacturing Industries.'

	No.	Children under 13.	Up to 18.		Males above 18.
			Male.	Female.	
Gloucester	1	..	..	..	6
Kent	1	..	23	..	844
Middlesex	3	..	405	..	2647
Stafford	13	2	41	68	205
Warwick	71	24	404	75	2821
Worcester	4	2	40	27	149
York	1	..	5	1	166

making in round numbers nearly 8000 in the trade. The Census gives the numbers as 11,210; but it is possible that in this is included the country gunsmiths, who work separately. The ages were:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
2	503	1642	1739	3060	1973	1227	685	272	107

There were also 366 females, although, as we shall see when we come to explosives, the latter are principally employed in this branch of the firearm trade. The county of Warwick, or in other words, Birmingham, is the great centre of the gun trade, and still contains a certain amount of the old subdivision of labour, although there is an automatic factory at Smallheath, similar to the one at Enfield, in Middlesex. Ten years ago, Mr. Goodman, the chairman of the Small Arms Company, gave the following list of employés in the Birmingham trade, in an article contributed to Mr.

Timmins' volume on 'Birmingham and the Midland Hardware Districts':

Material makers—

Stock makers		100
Barrel welders		700
„ borers		
„ grinders		
„ filers and breechers		
„ rib makers		
„ breech forgers and stampers		
Lock forgers		1200
„ machiners		
„ filers		
Furniture forgers		100
„ casters		
„ filers		
Rod forgers		100
„ grinders		
„ finishers		
Bayonet forgers		500
„ socket stampers		
„ ring „		
„ grinders and polishers		
„ machiners		
„ hardeners		
„ filers		
Band forgers and stampers		300
„ machiners and filers		
„ pin makers		
Sight stampers		300
„ machiners		
„ jointers		
„ filers		
Trigger boxers		20
Odd work makers		100
Carried forward		3420

Brought forward	3420
Setters up—	
Machiners	50
Jiggers, lump-filers, and break-off fitters ..	200
Stockers	1000
Percussioners	200
Screwers	1000
Shifters	20
Barrel borers and riflers	100
Sighters and sight-adjusters	50
Smoothers	100
Finishers and makers-off	1000
Polishers, engravers, browners, and lock-freers	200
Total	7340

Women are but partially employed, in making-off, that is, in sand-papering and polishing. Barrel smoothing is occasionally done by Irish women, but it is both dirty and laborious. The boys polish metal, blow fires, help to make the corks for muzzle-stoppers, and run errands, there being a vast interchange of the various parts of the guns amongst the respective operatives.

Wages.—Mr. Aitken observes * that "the earnings vary, but bear a relation to the ability and responsibility with which the workers discharge their several special requirements; and all earn higher wages than those of France, where, previous to the last wars, the average varied from 14*s.* 3*d.* to 16*s.* 7*d.* per week. In Belgium, at Liege, the centre of the gun trade, the average was 12*s.* per week, but this included the earnings of women and children; and the average of men was 20*s.* 10*d.* per week."

The mortality of gunsmiths appears to be rather

* 'British Manufacturing Industries.'

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above the average, probably on account of the dust that is given off during the several filing and forging processes. In 1871 it was 178, viz.:

15–	20–	25–	35–	45–	55–	65–	75
5	16	37	32	27	25	21	15

Except in the gun factories, the work is generally carried on in badly-built and ill-ventilated workshops; and there is also a good deal of garret work.

The exports of small arms have been as follows:

	Number.	Value.
		£
1870	494,366	871,419
1871	444,048	866,670
1872	387,815	477,117
1873	353,784	515,260
1874	235,413	377,614
1875	318,901	653,169

by which it appears that our export trade is somewhat declining.

In 1875 the items were:

	Cwt.	Value.
		£
Cannon and mortars	42,640	210,413
	Nos.	
Muskets	102,854	48,986
Rifles	147,049	472,980
Fowling-pieces	56,052	115,619
Revolvers	8,318	12,771
Other firearms	3,021	3,119
Parts of firearms	..	56,347
Swords and bayonets	..	7,232

Our chief customers were: for cannon, China; muskets, West Africa; rifles, South Africa and Germany; fowling-pieces, West Africa and America; revolvers, Australia.

VIII. Steel Pens.

The steel pen trade is almost entirely confined to Birmingham. It is difficult to say how many are employed in it; but Mr. Timmins tells us, in his book on Birmingham (1865), that there were then 360 men in the trade, and 2050 women and girls, the men earning per week from 18*s.* to 20*s.*, the boys from 4*s.* 6*d.* to 16*s.*; skilled adults from 30*s.* to 80*s.*, or even more; girls from 5*s.* to 12*s.*, the younger ones perhaps earning only 2*s.* 6*d.* to 3*s.* 6*d.*, while women made from 15*s.* to 20*s.*

In 1876, the average of a good female hand was 12*s.* to 14*s.* per week, though, taking women and girls, the wages (which are paid by the quantity) varied from 6*s.* to 16*s.*, according to skill and industry. Overlookers and tool makers are paid by the time, and earned 30*s.* to 70*s.* per week.

The operations of steel pen making, as detailed by Mr. Lindsey in his article,* are somewhat numerous, and give occupation to some twelve or thirteen sets of hands. The steel is cleansed from "scale" by soaking in dilute sulphuric acid, locally called "pickle;" then passed through rollers, cut into pieces of required size, pierced and ground. The pens are heated in a muffle furnace and thrown into oil, and, when tempered, are coloured over stoves, varnished, and dried.

* 'British Manufacturing Industries.'

The women and girls are largely employed in the presses, and the younger ones in sorting, counting, and packing up. Where the factories are well ventilated and arranged, there is nothing particularly unhealthy in the processes, except, perhaps, in the sand-papering of the penholders (where made), in which the dust flies very much. Sometimes, too, fingers are nipped and the ends taken off in the press, although most of the latter have now a guard to protect the hands.

The steel pen operatives have the advantage of being employed, as a rule, in well-arranged factories, the trade being in the hands of a few masters, who appear to have the welfare of their workpeople at heart. One of them, at all events, Sir Josiah Mason, has made himself conspicuous for his charities, especially those which apply to children.

IX. Screws, Nuts, and Bolts.

Mr. Aitken, in his articles on wood screws and railway bolts,* has shown us how ingeniously contrived is the machinery for making these useful little appliances, and how far the labour of the workpeople is lightened by the use of these machines. So little trouble do they give, that one girl can look after fifteen of them. The same may be said of the nuts and bolts, which, by Sir Joseph Whitworth's system of standard gauges, are produced so microscopically exact, as to make an universal system of screwage not only easy but desirable. Wood screws and bolts are principally made in the Black country, although for the production of the latter

* 'British Manufacturing Industries.'

there is also a large factory at Cwmbrân in Monmouthshire. The character of the work is that of a factory, for the capital required is so large, and the machinery is so expensive, that it is entirely taken out of the hands of the "little masters." This is all the better for the operatives, who are of a more intelligent type than usual. Mr. Aitken estimates the number of workers in both trades at about 1800 males and 1500 females;* and the wages, according to the Factory Returns of 1871, as follows:

	Per week.		Per week.
Bolt makers, good ..	28*s.*	Bolt screwers ..	3*s.* to 7*s.*
„ common	24*s.*	Bolt-maker's striker	15*s.*
Nut makers, large ..	30*s.*	Rivet cutters	7*s.*
„ small ..	25*s.*	„ picker-out ..	5*s.*
Rivet makers	24*s.*	Turner	28*s.*

There is not much scope in the screw trade for "skilled hands," as generally understood in trades, where small and highly finished articles are made. In 1876 women and girls earned about 9*s.* per week of fifty-four hours; the class above, or unskilled labour, from 22*s.* to 24*s.*; and the special artizan, from 42*s.* to 44*s.* All the work is piecework.

The statistics of the wood-screw trade shows how rapidly it has risen to importance. In 1849 the computed number made was 70,000 gross per week, a production which, in 1866, had risen to 130,000; while in 1873 one firm alone turned out 150,000 gross, or at the rate of 7,200,000 gross per annum. The estimated annual product throughout England is 1,296,000,000, consuming 9000 tons of iron wire.

* Screw cutters (females only) are given in the Census tables as 1479, of whom the majority were between fifteen and twenty.

X. Wire.

The wire trade is generally comprised under two heads—wire-drawing, which is done in regular mills with steam power, and wire-working, which is usually by hand. Taking the two together, the Census gives a total of 7435 males and 479 females, of ages

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
2	521	1356	1148	1796	1201	779	413	103	56

The great increase in this trade is shown by the fact, that about a century ago, a horse was used to draw the wire through the plates, and this animal represented the whole moving power of the Birmingham district. Wire making, however, is not now confined to this district, it being largely carried on at Warrington, Manchester, Sheffield, and Monmouthshire (near Newport). The conditions of this branch resemble those of the iron trade generally. No women or girls are employed in it, and the average earnings of a workman are 35*s.* to 50*s.* per week, in good times (Sheffield) from 40*s.* to 60*s.*, though it depends much upon the class of work. In wire-drawing, however, juvenile and female labour comes into play, in the shape of twisting and threading wire into the endless shapes and articles which emerge from a wire-drawer's shop. Weaving is usually done by men, who employ and pay boys to wind for them; and the latter are also occupied in watching the wire as it passes in the machines through the zinc baths, and is wound on to the blocks or wheels. Some of this work is heavy, requir-

ing a strong hand to lift the coil from off the wheels. Where galvanizing is carried on, the employment is kept on night and day, for were it not so, the contents of the bath would solidify and be useless for future operations. The smell and taste arising from these baths is anything but pleasant; but they do not appear to have a deleterious effect upon the health. The mortality table for 1871 shows a return of 107, viz.:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
1	1	2	14	17	15	16	18	16	7

The social character and conditions of wire makers are about the same as those in iron mills and factories; but those of the wire-workers do not appear to be so good, unless they have very much improved since 1865, when it is mentioned by a Birmingham witness, in the Children's Employment Commission, that "wire-workers generally are of the roughest and most ignorant class, probably next to the nail-workers. The language of some of the females is disgraceful." It is to be hoped that the progress of education within the last ten years has materially changed this.

Wire-working is a well-paid trade. In 1865 the wages averaged 28*s.* per week, while some of the drawers made from 56*s.* to 60*s.*; boys, from 4*s.* to 6*s.* In 1871 they were:

Weavers	36*s.*	Engineers	17*s.*
Drawers	39*s.*	Mechanics	20*s.*
Winders	9*s.*	Weaving apprentices	7*s.*
Stitchers	13*s.*	Drawing „	6*s.*
Dandy makers (for paper mills) ..	50*s.*	Boys	4*s.* 6*d.*

The apprentices earn 7*s.* for the first four years, and for the last three they get 15*s.*, and the drawers 19*s.*

Spring making, which may be included with the wire manufacture, is largely carried on at Sheffield. Spring makers work in pairs, viz. the fitter and the vice-man; conjointly they earn (1876) 90*s.* per week. The former gets 12*s.* in the pound, and the latter 8*s.*, so that a fitter's average earnings would be 48*s.* to 50*s.*, and those of a vice-man 32*s.* to 34*s.*

The exports of wire (not including telegraphic) for the last nine years were as follows:

	Tons.	Value.
		£
1867	19,406	382,301
1868	21,780	421,618
1869	23,751	435,778
1870	23,447	439,546
1871	26,200	446,159
1872	33,605	674,743
1873	29,445	692,470
1874	36,692	769,927
1875	43,077	781,073

Australia is by far our largest customer for wire, which is used in great quantities for fencing purposes.

XI. Explosives.

Although explosives at first sight can scarcely be classed under the metal trades, there is sufficient in the manufacture of caps and cartridges to group them under this heading.

As this branch of employment finds no place in the Census tables, I am unable to state from official sources

how many persons obtain their living by it. But, as far as *gunpowder* and *guncotton* are concerned, it is not a very large class, numerically speaking, as there are not many powder mills or guncotton manufactories in the country. Where the former exist, such as at Dartford, Waltham Abbey, Hounslow, or Langdale (in Westmoreland), they are placed in remote neighbourhoods, and with all the buildings more or less detached from each other, so as to diminish as far as possible the risk of explosion and the danger to human life. Explosions are not at all uncommon, but owing to these precautions, the danger done is perhaps reduced to a minimum. The work fortunately does not require any large number to carry it on, and those who are employed are experienced, staid individuals, as becomes those whom the least incautiousness would sweep into eternity instantaneously. The different stages of the manufacture are, grinding the materials, incorporating them into a paste, breaking down by means of rollers, pressing, "corning" or granulating, drying, dusting, and glazing. The incorporating is the most dangerous of these, and extra care is taken at this stage; at Waltham Abbey mills, a water tank being suspended over each mill in such a way, that an explosion of any one overturns its own tank and all the others of the set, and so floods all the charges. The rules are necessarily very strict, such as compelling everyone to go about with list shoes, while all the floors are covered with leather; grass is grown around and amongst all the premises; and the utmost care is taken (though sometimes fruitlessly) to prevent smoking and the introduction of lucifer

matches. I am not aware whether the manufacture of powder has anything detrimental to health in it; indeed, the daily risk is a sufficient drawback, without any further one. For all legislative purposes, gunpowder is provided for by the Explosives Act of 1875 (23 & 24 Vict.).

The exports of gunpowder are very large, viz.:

	Lb.	Value.
		£
1867	20,505,390	526,305
1868	16,721,002	394,458
1869	15,390,776	368,178
1870	17,357,668	427,229
1871	18,416,933	440,454
1872	20,021,331	487,119
1873	16,626,685	442,170
1874	14,930,995	415,716
1875	15,071,979	399,125

The largest exports of each year are to Western Africa, Australia, China, Chili, and Brazil.

The manufacture of *cartridges* and *percussion caps* is almost entirely limited to females; so much so, that in the Census tables the males find no place. Of the former, however, there were (*a*) percussion cap, 660; (*b*) cartridge, 1497, viz.:

	5–	10–	15–	20–	25–	35–	45–	55–	65–	75
(*a*)	1	60	289	139	102	41	23	4	1	
(*b*)	..	159	711	312	165	51	19	7	3	

It may be therefore called almost a children's trade. The number of factories at which either caps or car-

tridges are made is very small, the former being limited to some few in Birmingham and two in London. Caps are of two kinds, military and sporting; but although different in shape and appearance, there is no radical difference in the mode of manufacture. Strips of copper are cut out and punched, or "drawn through" into the shape of the cap by presses. After the edges are smoothed, the caps are cleaned in a chemical solution, dried in sawdust, and "primed" or charged with the detonating mixture or fulminate. This is generally mixed after certain trade formulæ, and away from the factory, where only a certain amount can be kept, according to the Explosives Act, viz. 24 oz. at a time. At Messrs. Eley and Company's, however, the fulminate is mixed with 20 per cent. of water, which does not in the least affect the detonating efficiency. The caps are primed by being placed in an oblong block, with hollow upwards, underneath two metal plates, with holes corresponding with the caps, though the plates are so placed with respect to each other, that their holes do not tally. The fulminate is first laid on the top plate, so as to fill the top holes; and then, by a sliding arrangement, the lower holes are opened, so as to let it fall into the cap. Once there, it is fixed by a little round bit of tinfoil "dropped in" by a waxed needle. The dangerous part of the operation is the priming. The mixing of the fulminate itself is dangerous; but then it has no business to be done at the factory. A very little bit of grit on the iron charging plates is sufficient to cause detonation; and as upwards of two thousand caps are dealt with at a time, the explosion is

very considerable, although it is remarkable with what *sangfroid* the workers regard the constant popping off of stray dozens. The mixing and priming are nearly always done either by men or adult women, who have had considerable experience at the work; and at Woolwich, the pressing down of the powder into the caps is performed by machinery, a force of 1000 lb. being applied to each cap. The factories in London are so excellently managed, that accidents have been but few and far between; but those at Birmingham being old, and (until of late years) not under such good surveillance, there have been several disasters, viz. in 1859, when nineteen lives were sacrificed, and again in 1862, when nine were killed and forty injured, three of the former being girls aged ten, thirteen, and fourteen respectively.

Cartridge making employs rather less girls than according to the Census returns, for the reason, that they have been discontinued at Woolwich Arsenal, where at that time 360 were engaged. The work of cartridge making is comparatively simple compared with cap making, and consists in cutting paper, plugging and gauging shot, forming the cartridge cases, making pulp insides, filling, twisting, lubricating, cutting, packing in bundles and finally in barrels. None of this work is injurious to health to either girls or boys, except perhaps the pressing, which is somewhat sickly work, and the sticking on the green bands, during which possibly some arsenite may be swallowed.

The following is the value of the exports of explosives since 1867 (except gunpowder). As no special

class of explosives is mentioned, the values refer to all kinds, such as caps, cartridges, guncotton, dynamite, blasting fusees, lithofracteur, &c.

	£		£
1867	551,920	1872	454,987
1868	366,151	1873	423,892
1869	395,952	1874	989,437
1870	675,259	1875	1,007,294
1871	1,088,869		

In 1875, no less than 530,246,270 percussion caps were exported, of the value of 56,398*l.*, principally to America, Australia, Bengal, Hong Kong, and New Granada.

XII. Engineering, etc.

The next class to which I shall allude is very large and important; indeed, it embraces so many handicrafts in itself, and is nearly allied to so many other trades, that it is difficult to separate them, or apportion each to its proper place. The term "engineer," or "machine maker," is a wide one, because it depends so much in what class of engineering or machine making the workman is engaged. The occupations have such a similarity to each in the way of physical requirements or the conditions of labour, that I cannot do better than group them together as they are grouped in the Census tables, viz.:

	Under 20.	Above 20.	Total.
Engine and machine makers ..	19,885	86,552	106,437
Spinning and weaving machine makers	2,406	7,262	9,668
*Agricultural implement makers	642	2,975	3,617
Millwrights	908	6,630	7,538

* See p. 115.

The Factory Returns give a total of 1762 factories for the manufacture of machinery, with an amount of 36,473 of steam power, and employing 506 children, 19,047 males up to eighteen, and 121,396 above, making a total, with 342 women, of 141,291. Of these Lancashire and Yorkshire absorb the great majority. In Scotland there are 171 factories, employing 22,294 persons, and in Ireland 51, giving occupation to 3434, making altogether for the United Kingdom a total of 167,019 engaged in these four branches of trade.

In the case of engineering and machine works, we have every variety of labour, from the minutest component parts of a railway engine, to the full-grown locomotive in all its beauty of paint and brass work; or from the smallest detail of a spindle, to the enormous plant of a cotton mill, with its hundreds of thousands of intricate details. A glance at the Lancashire Post-office Directory will indicate the subdivisions into which engineering machinists are formed, such as beetle-finishers, makers of cotton and woollen cards, cylinders, devils, doctors, doffing plates, dometts, fustian tools, spindles and flies, spinning springs, jacquard machines, looms, pickers, pinion wires, reeds, reed-hooks, temple teeth, throstles, &c. Many of these are "small" machinists, while others are of the calibre of Messrs. Platt Brothers, of Oldham, who employ some 5000 hands at their vast establishments, which contain not only machine works, but foundries, forges, brick works, &c. For large engineering works, we may take as samples the London and North-Western Works

at Crewe, the locomotive factory of Messrs. Stephenson, at Newcastle, or the extensive Atlas Works at Manchester, belonging to Messrs. Sharp, Stewart, and Co., or of Messrs. Beyer and Peacock, of Gorton, which have specialities for turning out railway engines; and those of Messrs. Hick and Co., of Bolton, where all sorts of stationary engines are made.

The employment of agricultural implement making is scattered over the agricultural districts, the chief places noted for this occupation being Ipswich, Bury St. Edmunds, and Leiston in Suffolk; Lincoln, Grantham, Newark, Bedford, Rochester, Leeds, &c. Although the trade is a comparatively modern one, it is daily assuming larger proportions, and is destined to become a very important English industry. The Census gives us only 3617 agricultural implement makers in the kingdom; but this is a manifest error, for many of the large works employ over 1000 hands each; and I am informed on good authority that the total number would be more like 20,000.

There is nothing very special to state as regards the occupations of the various classes of employés and the influence upon health, for it so entirely depends upon what the occupation is. There is nothing in the mechanics' or fitters' shop which is prejudicial; but when the supplementary work of glazing, grinding, brass-founding, or filing is added, we naturally find the deleterious effects of the dust or the brass fumes, as has been described before. Wounds, burns, and fractures are of course accidents which are common to all these industries; but the

only two special results of the occupation which I have been able to gather, are (*a*) from the use of naphtha amongst the French polishers of the woodwork of machines, and (*b*) amongst the spindle makers; the men who "stretch" or strengthen the spindles suffering from a certain affection of the eye, arising from the flash of light along the spindle. The following table is that of average earnings of operatives engaged in this class of work (1871):

	s.	s.	
Engine fitters	24 to	34	per week.
Agricultural fitters	25		„
Engine smiths	30 to	42	„
Agricultural smiths	25 „	30	„
Boiler makers	28 „	45	„
Machinists (wood-men)	24 „	40	„
Iron and brass moulders	28 „	32	„
Painters	18 „	22	„
Day labourers	12 „	16	„
Pattern makers	26 „	36	„
Planers	30		„
Hammer-men	14 „	17	„

Locomotives:	s.	
Fitters and finishers	25	per week.
Turners, shapers, planers, and slotters	25	„
Drillers	16	„
Erectors and boiler mounters	27	„
Coppersmiths	28	„
Grinders	31	„
Smiths	26	„
Boiler makers	26	„
Forge-men	35	„

The United States Consul at Newcastle-upon-Tyne writes in 1874 as follows:

"During the year 1871 a complete revolution took

place in the labour market. Not only the working hours were reduced, but in consequence of the increased demand for nearly every material and manufactured commodity produced in this country, and the very considerable rise in the cost of living, wages have been gradually advancing. An engineer (erector and fitter) while working ten hours a day, received only 26*s.* as his weekly wage (previous to the engineers' strike); at present, with nine hours as his day's work, he obtains 30*s.* per week." *

The following table is a schedule of weekly wages in 1875 paid in the Manchester districts:

	I.		II.		III.				IV.	
	s.	*s.*	*s.*	*s.*	*s.*	*d.*	*s.*	*d.*	*s.*	*s.*
Smiths	35	30	40	24	38	3	27	0	32	
Platers	38	..	38	..						
Turners	34	32	35	24	34	10	30	4	34	32
Fitters and erectors ..	38	32	36	26	36	9	32	0	34	32
Planers..	28	24	28	22	29	3	20	3	26	
Shapers..	24	22	27	20	25	10	22	6	24	17
Slotters..	22	19	27	22	25	10	20	3	24	
Drillers..	22	18	27	18	26	9	18	0	24	18
Iron moulders—sand..	36	32	36	36	40	0	34	0	36	32
Brass moulders—sand	32	32	34	34	40	0	40	0	34	
Pattern makers	34	30	36	28	36	0	34	3	36	32
Coppersmiths	34	32								
Grinders	32	30	32	32	..		..		34	32
Painters	32	28	32	28						
Ordinary labourers ..	17	17	18	17	20	3	18	0	16	

Nos. I. and II. represent two important engineering shops; No. III. an equally important tool-making shop; and No. IV. a large shop for the production of cotton machinery, the highest and lowest rates paid per week being given in each case; and the inquiry was directed to the rates paid to good ordinary workmen from thirty to forty-five years of age. Piecework is in force in each shop, by which means the earnings are increased by from 25 to 35 per cent., over the above rates, on a week of fifty-four hours.

For federative purposes, such as trade unions and friendly societies, engineers and machinists are represented by some twelve bodies, containing in the

* 'Labour in Europe and America, 1875.'

aggregate about 55,000 members, of which one alone, viz. the Amalgamated Society of Engineers, has 44,000 (p. 122). As regards the mortality of the trades, the Registrar-General's report in 1871 gave it thus:

	Under 20.	Above 20.	Total.
Engine and machine making ..	80	1373	1453
Spinning, &c., machine making	6	173	179
Agricultural implement making	2	52	54
Millwrights	5	154	159

The value of the exports of machinery for the last nine years was:—

Year.	Steam Engines.	Other sorts.
	£	£
1867	2,026,072	2,942,436
1868	1,724,783	3,004,699
1869	1,798,282	3,303,384
1870	1,997,523	3,295,750
1871	2,064,004	3,902,037
1872	2,603,390	5,595,702
1873	2,927,617	7,092,312
1874	3,255,685	6,535,229
1875	2,620,491	6,478,222

XIII. Ship-building.

The last important trade more especially dependent on our finished metals, to which I shall allude, is that of iron ship-building, the capital invested in which is enormous. Indeed, taking into consideration all the interests directly or indirectly involved in our marine, ship-building stands amongst the first of English industries. Of ship builders, shipwrights, and boat builders

(excluding sailmakers), there were (1871) in England 40,605, viz.:—

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
0	817	4,413	6,006	11,022	7,774	5,860	2,818	1,327	568

by which it will be seen that a good number of boys, and the flower of our population as regarding age, were employed in this trade. But from this aggregate we must deduct one-half, as being engaged on other than *iron* ships, the localities for building which are comparatively few, while every little port is competent to build a wooden vessel of more or less tonnage. Of iron ship-building establishments there were (in 1871) forty-eight in England and Wales, thirty in Scotland, and five in Ireland, the bulk of which were at the ports at the mouth of our great rivers.

	No. of Factories.	Males under 18.	Males above 18.	Total.
England	48	2,743	17,717	20,460
Scotland	30	2,279	21,696	23,975
Ireland	5	335	2,816	3,151

The Thames, Tyne, Wear, Clyde, and Mersey are the principal seats of iron ship-building, although the former river, which used to lead the trade, has fallen off since the great strike a few years ago. Ship-building is a trade of specialities: one firm being celebrated for its war ships; another, for its mercantile marine; a third, for yachts, &c.; and contains in itself a considerable number of subsidiary occupations, as will be seen in the following table of wages. Wooden ships

are still built largely in some of the Scotch northern ports, such as Aberdeen, but, as a rule, iron is fast superseding them.

The average weekly earnings are:

	1871.		1874.
	s. d.	*s.*	*s. d.*
Blacksmiths	25 0 to 36 ..		30 0
Angle-iron smiths	26 0 „ 39 ..		27 0
Hammer-men	15 6 ..		18 6
Riveters	21 0 „ 30 ..		27 0
Platers and fitters	24 0 „ 38		
Caulkers	22 0 „ 36 ..		27 0
Labourers	14 0 „ 21 ..		16 0
Rivet-boys and holders-on ..	6 9 „ 9 ..		7 6
Carpenters and boat builders	27 0 „ 36 ..	32 to 33	0
Joiners	27 0 „ 33 ..		32 0
Block makers	24 0 „ 36 ..		29 0
Painters	30 0 ..		31 0
Riggers	26 0 „ 30 ..		24 9
Machinists	23 6		
Borers	16 3		
Helpers	.. ..		16 0

The shipwrights at Barrow-in-Furness are paid (1876) an uniform rate of 33*s.* per week for fifty-one hours in winter and fifty-four in summer.

A class of men specially employed on iron ships are the "platers" and "riveters," each set of which has two boys or so to heat the rivets for them, which they do in a little furnace near the workmen. There is nothing unhealthy in the occupation for either man or boy, except, perhaps, that they have often to work in a dangerous position. The mortality of the trade in 1871 was 839, of whom 27 were under and 812 over twenty.

The statistics of ship-building show us how greatly

our steam tonnage has increased within the last half century, and I reproduce a short table given by Captain Bedford Pim, M.P., in his article* on the subject:

Year.	Steamers.	Tons.	Averages.
			tons.
1820	56	8,300	148
1830	315	33,444	107
1840	824	95,807	116
1850	1,350	187,631	138
1860	2,337	500,144	214
1870	3,796	1,202,134	317
1874	4,835	1,987,235	411

That the Clyde has had a large share in this production, is evident by the following table of tonnage launched, during ten years:

Year.	Tons.	Year.	Tons.
1863	124,000	1869	192,300
1864	178,505	1870	180,401
1865	153,932	1871	196,229
1866	124,513	1872	224,000
1867	108,024	1873	261,500
1868	169,571	1874	244,467

Of all classes of vessels, the tendency to building sailing vessels and screw steamers increases, while paddle steamers are annually decreasing. The lead that has always been taken by the Clyde in shipbuilding has not been caused by the superiority of individual builders, so much as that materials are cheaper in the Glasgow neighbourhood, while skilled labour has been always more abundant and less costly

* 'British Manufacturing Industries.'

than in England. The reader will probably have noticed what great differences exist in the wages for the various divisions of labour; and it will be sufficient for me to state, that the minimum rate in shipbuilding is almost always that of Glasgow, while the highest is that of the Thames.

In a trades union point of view, that large section of operatives which comes under the appellation of "engineers," is one of the most important that exists.

At the close of 1874 the Amalgamated Society of Engineers had 43,150 members, and a total income in

1870	.. ..	of £85,329
1871	.. ..	„ 91,271
1874	.. ..	„ 118,556

And taking the whole trade, iron-moulders, boiler makers, and others, it is probable that there are upwards of 70,000 men in union.

Dealing with so many members, it is not perhaps surprising that this Society carries on a somewhat aggressive warfare against the employers. The principal points at issue appear to be, the abolition of piecework (the last great attempt at which was at the Erith Ironworks, a case of some historic celebrity), the limitation of apprentices, the doing away with the "inquiry note" on the part of employers, and the obtaining throughout the country of a minimum rate of pay, below which no wages should go.

Nor is it much to be wondered at, that, with so comprehensive a programme, employers should have been driven to organise themselves in self-defence.

CHAPTER IV.

CHEMICAL WORKS

Form the next branch of trade to which I shall direct attention, and in so doing, I would only allude to the rapidly increasing importance which they are assuming in this country. The spread of chemical and scientific knowledge is daily causing the adoption of new processes and applications, which often revolutionise the old methods of production, and frequently develop a trade in a direction which was quite unexpected. It is to the increase of our chemical knowledge that our superiority in metallurgy, as well as in the more delicate operations of industrial art, is owing; and we cannot therefore overrate the value of our chemical manufactures. The Census tables give the numbers engaged in these trades (not including dyeing, calendering, &c., which will be dealt with under textiles) as 10,736, of whom 1334 were under, and 9402 above twenty, viz.:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
1	334	999	1,388	3,064	2,334	1,470	846	253	47

There were also 592 females, of whom 260 were under, and 332 over twenty. In the Factory Returns for 1871, chemical works are made to include soap,

candle, oilcake, and artificial manure making, the special chemical manufactures forming a separate division.

	No. of Works.	Males under 13.	Up to 18.		Males above 18.	Total.
			M.	F.		
England ..	108	30	1,756	763	16,876	19,425
Scotland ..	9	...	106	75	1,743	1,924

The principal seats of the trade are Middlesex (the Thames and Lea), Lancashire (Runcorn, Widnes, and St. Helen's), and Durham (the Wear and Tyne), in which counties two-thirds of the establishments are found; of these, Widnes is probably the most typical chemical district in the kingdom, being almost entirely devoted to it, greatly to the prosperity of Lancashire, but very much to the detriment of the appearance of the surrounding country. Our large chemical manufactures comprise those of sulphuric acid, hydrochloric or muriatic acid, with bleaching powder (chloride of lime), nitric acid or aquafortis, acetic, citric, and carbolic acids; sulphates, such as potash, soda, ammonia, with a number of minor chemical compounds, for which perhaps one or two firms may have a speciality.

In no trade has the utilization of waste materials been so exemplified as in the chemical trades; and Mr. P. L. Simmons, in his interesting work on this subject,* has shown us numerous examples of this, many of the incidents occurring in their history being of a very curious nature, as, for instance, in the manufacture of sulphuric acid, which, up to 1838, was entirely dependent on the supplies of sulphur from Sicily. But

* 'Waste Products and Undeveloped Substances.'

in that year the King of Naples granted a monopoly of the mines to a French company, so that the sulphur immediately went up from 5*l.* to 14*l.* per ton.* The British makers were thus driven into a corner to find other sources, and this resulted in the discovery and adoption of means for producing sulphur from the iron pyrites so abundant in Ireland, and also the recovery of the material used in other processes, such as the iron oxide for purifying coal gas. The processes of Mr. Weldon for making chlorine on an economical scale, and of Mr. Musprat, afterwards improved upon by Mr. Gossage, for making soda from the decomposition of salt, are amongst the most interesting facts of British trade development.

In addition to the principal groups of acid and alkali manufacture, for the details of which I must refer my readers to Professor Church's able article,† there are a very large number of smaller ones—the soda group alone embracing those of sodium acetate, arseniate, bisulphate, manganite, permanganite, silicate, stannate, and phosphate, "all of considerable importance and employing much skilled labour."

Upwards of 292 different varieties of chemical trades are enumerated in Kelly's 'Trade Directory.'

Chemical manufactures are not of the most healthy, although, when we consider the many vapours evolved in the various processes, it is surprising that the sanitary condition of the workman is not worse. The chief vapours which affect him are sulphuretted hydrogen, which produces, after inhalation, diarrhœa,

* 'Report on Noxious Vapours,' 1862.
† 'British Manufacturing Industries.'

rapid pulse, and symptoms of low continued fever; chlorine, the effects of which are transient and less serious, viz. suffocation, cough, and difficulty of breathing; nitric acid, the vapour of which gives rise to dryness of the throat and constipation; hydrochloric acid, which produces spasm of the mucous membrane of the nose, mouth, and throat. Amongst the less known sources of mischief, according to Dr. Richardson,* is the vapour of aniline, which induces a peculiar neuralgia, and, in marked cases, insensibility, with sometimes ulceration of the skin on the lower extremities; also the vapour of nitro-benzole, which tends to coma and apoplexy. Of the evil effects of the various acids on vegetation I have spoken before, in describing the copper smelting (p. 57).

The mortality tables give the deaths at 260, viz.:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
0	0	7	29	54	47	42	32	36	13

and as compared with all classes it is:

	15–	20–	25–	35–
Manufacturing chemist	·625	1·277	1·138	1·558
All classes	·632	·859	·985	1·305

	45–	55–	65–	75
Manufacturing chemist	2·073	3·853	9·804	24·460
All classes	1·853	3·215	6·676	16·584

* Unhealthy Trades. Lectures at the Society of Arts, 1875.

The Registrar-General observes that "the mortality of chemists and druggists is high and above the average, especially in the younger ages. Manufacturers of dyes, chemicals, and colours also experience a mortality above the average."

Wages.—The average weekly earnings were in 1871:

	s.	s.
Sulphuric acid makers	26 to	28
Sulphate of soda „		33
Crude soda „		28
Caustic soda „		28
Carbonate of soda „		31
Crystals of soda „		26
Bi-carbonate of soda makers		26
Bleaching powder „		35

In the present year (1876):

Labourers commence at ..	21*s.* per week, rising to 25*s.*
Foremen over labourers ..	35*s.* to 40*s.*
Carpenters	9*d.* per hour.
Fitters	8½*d.* „
Stokers	37*s.* 6*d.* per week.
Assistant chemists, from ..	150*l.* to 400*l.* per annum.

Our imports of chemicals since 1867 have been:

	Alkali.	Sulphur.	Nitrate of Soda.	Pyrites.	Saltpetre.
	cwt.	cwt.	cwt.	tons.	cwt.
1867	78,532	1,166,729	..	272,698	1,217,752
1868	109,632	1,261,504	..	229,720	1,029,055
1869	84,718	1,010,975	..	319,947	899,151
1870	92,497	1,065,360	1,132,647	411,512	295,538
1871	101,560	937,049	1,444,341	452,047	341,618
1872	88,921	1,000,993	1,592,346	516,299	355,672
1873	95,336	909,352	2,393,204	520,989	331,517
1874	109,527	1,036,427	2,117,170	500,831	294,419
1875	95,555	1,117,538	3,382,636	539,256	282,705

The amount and value of the alkali exported were:

	Cwt.	Value.
		£
1867	3,164,475	1,624,597
1868	3,499,587	1,499,842
1869	3,516,036	1,379,504
1870	3,853,393	1,486,045
1871	4,176,667	1,747,269
1872	4,458,045	2,489,363
1873	4,754,425	2,929,006
1874	5,010,616	2,618,034
1875	5,030,684	2,300,092

principally to the United States, Germany, Holland, and Russia.

And that of the remaining chemical products:

	£		£
1867	565,461	1872	1,859,893
1868	568,981	1873	1,754,797
1869	710,418	1874	2,143,049
1870	1,227,179	1875	2,190,455
1871	1,588,763		

I. Soap and Candles.

The number of persons engaged in these two allied trades was in 1871:

	Males.	Females.	Under 20.	Above 20.
Soap boiling	1,819	..	300	1,519
Tallow chandlery ..	3,710	285	630	3,365

and according to the Factory Returns:

	No. of Works.	Children up to 13.	Up to 18.		Above 18.	Total.
			M.	F.		
Soap ..	15	4	231	73	911	1,219
Candles ..	5	25	423	106	884	1,438

The manufactories in which soap boiling is carried on are usually in the suburbs of towns, where the surrounding population can least be affected by the smell. Soaps, as Professor Church tells us,* are the combination of some fatty material with an alkali; and the chief process consists in heating these materials in properly constructed pots or pans, usually done by steam, and afterwards separating the soap from the mass of the liquor, and casting it in iron frames or moulds, to be subsequently cut up by wires. The occupation of soap boiling has usually been associated with all that is nauseous and horrible, besides being of a most unhealthy character, but this is not founded on fact. It is true that the ammoniacal odours given out from decomposing organic matters are not pleasant, and it is said that ammonia disengaged in this way makes the blood unduly fluid, and induces anæmia; but for all that, no definite ill-health has been known to follow the employment, more particularly in the present day, when greater care is bestowed by proprietors on the ventilation and arrangement of their works.

* 'British Manufacturing Industries.'

The divisions of labour are:

a. Those employed in the preparation of the fatty material for conversion into soap, bleaching it, &c.
b. Under-foremen and soap boilers.
c. Soap cutters, who cut the blocks into bars.
d. Soap packers.
e. Those employed in stamping and preparing fancy soaps.

The wages of soaperies differ very much according to the locality; but they may be taken generally, in 1876, as follows:

a. 20*s.* to 25*s.* per week.		*d.* 20*s.* to 25*s.*	per week.
b. 30*s.* to 40*s.*	„	Foremen, 30*s.* to 35*s.*	„
c. 25*s.* to 30*s.*	„	Boys, from 5*s.* to 12*s.*	„

The week comprises 60 hours, from 6 A.M. to 6 P.M. daily, except Saturday. Much of the work, especially under the heads *c* and *d*, is piecework, and in busy times a man can earn at least 30 per cent. by working overtime.

The exports of soap were:

	Cwt.	Value.
		£
1867	219,372	289,206
1868	197,768	257,565
1869	152,197	215,938
1870	157,123	218,345
1871	175,031	237,502
1872	233,933	304,397
1873	183,750	243,047
1874	219,129	277,723
1875	250,768	311,015

No trade has undergone such revolutions as that of candle making. Formerly it was a mechanical occu-

pation, but it has now become a chemical one, and consequently, many of the conditions under which the work was carried on are altered. Mr. Mattieu Williams, in his interesting article on Oils and Candles,* has shown us the gradual progress of these changes. Tallow dips, which are mostly produced in small, semi-private houses, and mould candles, are made pretty much in the same way as of old, although the process has been improved and hastened by using the American system, in which the wick is made to pass through the mould, so as to be drawn up out of it with the candles, as the latter are wound up by a rack and pinion; the old method being to string a set of wicks separately for each batch of candles. But when we come to the spermaceti, stearine, or paraffin candles, we find that an elaborate chemical process has quite superseded the older and more mechanical ones. Comparatively few boys or females are now employed in candle factories; and where they are so found, their work is to attend to the moulds, set the wicks, cut the ends of the candles, and so forth. The females principally work in the night-light department, forming the cylinders, cutting them into rings (by machinery), putting the bottoms in, and gumming the labels on. The work is simple, and free from any unhealthy surroundings. The ordinary divisions of labour are:

a. Foremen and under-foremen, employed in distilling the fatty matters.
b. Workers in the hydraulic presses for producing stearine.
c. Moulders and candle packers.

* 'British Manufacturing Industries.'

The wages are (1876):

a. Head foremen, 60*s.* per week; others, from 20*s.* to 35*s.* or 40*s.*
b. From 17*s.* 6*d.* to 20*s.*
c. Moulders, 25*s.* to 28*s.*; packers, 10*s.*

During the last few years, boys' and youths' labour has increased in value more in proportion than that of men.

The following are the statistics of the imports of tallow and stearine for the last nine years, principally from Russia:

	Cwt.	Value.
		£
1867	1,105,458	1,508,777
1868	1,237,348	1,886,327
1869	1,225,789	2,033,626
1870	1,530,893	3,318,566
1871	1,482,397	3,111,751
1872	1,326,850	2,835,021
1873	1,521,031	3,133,357
1874	1,154,799	2,318,251
1875	963,212	2,036,887

And the exports of candles:

	Lb.	Value.
		£
1867	4,851,097	180,468
1868	5,407,239	202,327
1869	4,412,435	161,013
1870	3,871,878	132,658
1871	5,569,079	180,548
1872	6,809,116	223,452
1873	6,592,990	220,776
1874	5,458,753	187,777
1875	5,306,525	177,108

Australia, the West Indies, and South Africa are our three best customers for candles; while for soap, the countries which take the largest quantities are: West Indies, South Africa, Java, China, and Spain. In addition to the tallow and stearine, there is a large yearly importation of spermaceti, palm, cocoa-nut, and olive oils, all of which are used in great quantities for the candle trade.

II. Lucifer and Wax Match Making.

While on the subject of candles, that of lucifer matches naturally follows, especially as of late years the trade has been so greatly improved, as to have become almost elevated to the dignity of a British Industry. It is emphatically a trade of young girls, there not being, according to the Census tables, any males engaged in it. This, however, is not altogether correct, for boys as well as girls are found in the factories, though only to a very small extent. The females were enumerated at 515, of the following ages:

10–	15–	20–	25–	35–	45–	55–	65–	75
102	243	91	41	16	11	7	3	1

by which it appears that nearly three-fourths were not yet out of their teens. The Factory Returns, however, gave a very different estimate of the numbers employed.

There were, according to these tables:

	No. of Works.	Children under 13.	Males under 18.	Males above 18.	Females.	Total.
England ..	36	152	525	453	1594	2724
Scotland ..	3	76	59	49	167	351
Ireland	3	21	35	20	66	142

but Kelly's Trade Directory states that there are 27 makers in London and 25 in the provinces.

At all events there is a population of over 3000 engaged in this occupation, the bulk of the factories, in proportion to the number, being situated in London. Lucifer match making was looked upon, not very long ago, as one of the lowest, dirtiest, and worst paid of employments, as it was certainly the most unhealthy. The trade was principally in the hands of little masters, who carried it on in workshops, which, as often as not, were mere garrets; but fortunately it has latterly been taken up by men with capital and energy, such as Messrs. Bryant and May, Bell and Black, and others of this class, who, while making fortunes for themselves, have raised a large number of children out of the gutter, and taught them habits of cleanliness and respectability. This has been done, not only by building large and well-arranged factories, but by substantial improvements in the manufacture of the match itself, by which the danger of loss of health has been to a great extent taken away.

The operation of making a lucifer match is a simple one, although, small as it is, it goes through a good many hands ere it is ready to be lighted. Fine fire-

wood is cut and re-cut (usually by machinery) from planks into small blocks, and then into splints double the length of, although the same size as, the match. The splints are then dried, sorted, tied in bundles, placed on hot irons, and dipped, either into sulphur or some fatty matter, such as stearine. Next comes the "dipping" proper, in which the bundles are arranged in clamps and placed in the "compo," or phosphorus mixture. After being dipped, they are shaken out, so as to prevent them sticking, cut in half, and placed in their boxes. The extreme unhealthiness of the trade consisted in the phosphorus dipping. The lucifer match itself only dates from 1833, and was said to be an invention of Swedish origin; but after it had been in existence here for about ten years, rumours came from abroad (and indeed the attention of our own medical men had been attracted to it) of a horrible disease, which was said to be the result of absorbing phosphorus into the system. The reports were but too true. It was clear that phosphorus was the cause of a certain malign influence on the bone of the jaw, mostly the lower jaw, which produced necrosis, or death of the bone, and during its course entailed on the sufferer the most frightful pain and the most hideous mutilation. It began with toothache, and if not stayed at this earlier stage, the jaw and gums swelled, the teeth dropped out, abscesses formed, and the jaw-bone eventually came away in pieces. Every match, now such an essential in our households, represented in those days an amount of wretchedness and suffering horrible to think of. Nor was this the

only drawback to the trade, for those engaged in it were so completely imbued with the phosphorus vapour, that their clothes and even their bodies perpetually shone with a pale lambent light, so that they became offensive both to the sight and smell, and were almost pariahs amongst their fellows. This is now, happily, a thing of the past, although there are still a few small and badly-regulated match shops. The greater part of these, however, have been swept away, and the trade aggregated into factories, which have the benefit of good ventilation and the most rigorous discipline as to cleanliness. The most substantial improvement has been in the adoption of the amorphous, or red phosphorus, which, as compared with the white phosphorus, is practically harmless. It is considerably more costly than the white, but its superior advantages very soon ensured its introduction. Apart from the dreadful jaw disease, phosphoric fumes produce, according to the late Dr. Letheby, a good deal of local irritation in the bronchi and the alimentary canal, causing prostration, loss of appetite, and wasting away. This, too, has been to a great extent done away by the use of ventilating fans and local preventives, such as saucers filled with turpentine placed close to the workers, one part of vapour of turpentine in 5000 parts of atmospheric air being sufficient to neutralize the phosphorus fumes. Burns are not uncommon, nor is this surprising, considering how frequently the matches must catch fire; but sand or a wet cloth is, or should be, at hand to put the fire out. Together with the improvement in health and appearance, there has been an equal one in morals

and general character, and match makers now hold their own with most other classes of operatives. The average earnings of women were 10*s.* to 12*s.* per week, young children 4*s.* to 5*s.* In 1871 the following statement of wages paid in Manchester was issued by the Factory Department:

	Per Week. s.	d.	
Chip-box makers	2	8	half-timers, girls.
„ „	8	5	full-timers, women.
Machine frame fillers ..	10	10	„
Match-box makers	10	2	„
„ fillers	8	0	„
Odd hands	2	8	half-timers.
„	15	0	full-timers.
Wax vesta and fusee makers	9	10	„ women.
„ „	3	6	half-timers, boys.
Match-cutting (boys over 13)	7	0	full-timers.
Sawyers and labourers ..	18	9	„

Since 1871 the tendency has been upwards.

At the present time in London, the greater part is done by piecework, and much depends on the regularity of the "hand." Some will earn from 14*s.* to 15*s.* per week; others from 22*s.* to 25*s.*

Wax vestas and vesuvians are also made by the million, and employ rather a higher grade of operatives, the work being cleaner and requiring a little more skill. A cotton wick is wound off from two cylinders and run through a composition, the gauge of thickness being taken by a perforated metal plate. It is then reeled on to drums, which hold sufficient to measure 150 miles, and cut into the requisite lengths, after which it is dipped into the lighting composition, dried, and boxed. The vesuvians are made like the

matches, except that the only phosphorus about them is at the very tip of the round black bulb which is so familiar to smokers. Fusees are strips of brown paper steeped in saltpetre, the ends being separated in alternate directions when the composition is put on, to prevent them sticking. A curious fact has been stated by observers of the lucifer match trade with regard to the women employed, viz. that those who make matches at home have nearly three times as many children, as those working in the factory.

As regards the boxes in which lucifers are packed, an enormous amount of outside employment was formerly given in their manufacture. A great deal of this, however, has been absorbed into the factory, where, if on anything like a large scale, the whole of the operations are now conducted from first to last. As in the case of steel-pen boxes at Birmingham, machinery is almost entirely used, not only for cutting up the wood, but for turning out ready-made boxes.

I have no means of ascertaining what is the production of lucifer or vesta matches, but it has been roughly estimated (though after all it is mere guesswork) at from 10,000 to 15,000 gross per day. A gross equals 144 boxes of 100 matches each.

The value of the exports in 1875 were:

	Value. £		Value. £
Turkey	6,738	Bengal	13,022
China	5,385	Hong Kong	7,096
Brazil	7,059	Australia	94,052
Bombay	7,652	Other countries ..	25,000
Madras	1,902		

CHAPTER V.

CERAMICS AND GLASS.

I. Pottery.

In whatever light we regard it, whether of the numbers engaged, the money value to the country, or the part which it plays in the art education and refinement of the masses, it is difficult to overrate the importance of the ceramic trade amongst English manufacturing industries. It is one of the most curious and interesting examples of the localization of a trade that we have, and may well excite the wonder of the traveller in North Staffordshire, who visits for the first time the densely populated district of the Potteries, with its multitudinous chimneys pouring out volumes of black smoke. The reasons for the localization of many of our trades are often difficult to discover, and none more so than that of pottery, for, with the exception of coal, none of the materials used in the trade are found in the neighbourhood. The china clay comes from Cornwall, and the flints from the chalk districts, and these are the principal essentials for pottery making. It is singular, too, that the trade settled here, in an inland portion of the country, long before the present facilities for traffic existed, for these to a great extent annihilate distance and reduce the expense

of carriage to a minimum; but previous to the establishment of the railway system, and, still earlier, the canal system, the cost and difficulty of supplying the potteries with their requirements must have been very great. With all this, the trade has never ceased to flourish from the day when it was first started. In many other places it has been tried, and only met with a partial success; but the prosperity and development of Stoke-upon-Trent and the surrounding towns have been so great and so continuous, that, since 1801, the population has increased from 23,626 to 187,225 in 1871. The district known as "The Potteries" is, in point of area of but small size, occupying a corner in the north-west portion of Stafford, a hilly and naturally picturesque bit of country of some 10 or 12 miles in length, and embracing the towns and villages of Stoke-upon-Trent, Burslem, Tunstall, Newcastle-under-Lyne, Hanley, Shelton, Etruria, Longton, Cobridge, &c. The whole district, in fact, including iron and coal works, is one immense manufacturing centre, with but little or no interval between each town.

I will now deal with the numerical conditions of the pottery trade, including, of course, all similar establishments in the kingdom, though, as regards the numbers to which they give employment, they are not so important, as they are celebrated for the specialities of their manufacture. According to the Census tables of 1871, there were in England and Wales engaged in the earthenware trade, exclusive of tobacco-pipe making: males, 29,169; females, 15,953; and of this number North Staffordshire, or the pottery district,

absorbed 20,728 males and 13,923 females, two-thirds of the whole. The relative ages were as follows:

	5–	10–	15–	20–	25–	35–	45–	55–	65–	75
Males ..	84	3090	5247	4029	6603	4874	3091	1482	525	144
Females ..	31	2318	5011	2801	2756	1511	894	445	150	36

by which it will be seen that the manufacture employs much juvenile life. The Factory Returns place potteries and earthenware under separate headings, and give the following statistics of the former trade:

	No. of Factories.	Children under 13.	Males up to 18.	Males above 18.	Females above 13.	Total.
Devon ..	3	..	16	48	31	95
Durham ..	32	21	173	588	347	1,129
Essex ..	4	4	19	23	..	46
Gloucester	2	..	76	163	123	362
Hants ..	8	1	24	88	2	115
Hereford ..	1	..	4	36	12	52
Kent	16	1	50	206	..	257
Lancaster ..	7	6	23	77	14	120
Leicester ..	1	..	..	12	36	48
Middlesex ..	9	5	75	150	26	256
Monmouth	3	..	7	14	3	24
Norfolk ..	4	4	7	17	2	30
Northumberland ..	9	26	85	312	348	771
Nottingham	4	40	40	30	2	112
Salop	4	12	59	355	221	647
Stafford ..	315	2,971	3,954	14,283	12,061	33,269
Suffolk ..	8	4	20	18	..	42
Surrey ..	14	1	232	696	5	934
Sussex ..	14	10	44	176	..	230
Worcester ..	14	..	132	480	349	961
York	45	31	321	1,053	734	2,139
Total ..	517	3,137	5,361	18,825	14,316	41,639

To these we have to add a total of 9130 engaged in the earthenware alone, which brings up the English sum to 50,769. In Scotland there are twenty potteries and twenty-five earthenware works, employing a population of 4181, of whom the females form about one-third. Ireland possesses four potteries and twenty-seven earthenware works, employing a total of 522, so that altogether we have in the United Kingdom 55,472 persons directly engaged in ceramics. As I stated before, many of these establishments are local and unknown to fame, while others are household words, wherever art education has made progress. In Staffordshire are the works of Minton, Copeland, Davenport, Wedgwood, Brown-Westhead, Hollins, and others, most of these being of historic celebrity; while in Devonshire we have the Watcombe brown pottery, in Salop the Coalport ware, and the tile-works of Messrs. Maw, of Broseley; and in Lambeth the pottery of Messrs. Doulton. Worcester is celebrated all the world over for its beautiful china; while Ireland is attaining a well-earned celebrity with the Belleek ware. I merely mention these well-known names, as examples of the specialities of the trade. Other places are equally, if not more, familiar to virtuosi and collectors, such as Bow, Liverpool, Derby, Bristol, Swansea, Nantgarw, which have played their part, and are now defunct.

Like other large industries, pottery has been greatly influenced of late years by the improvements that have been made in it, telling not only on the character of the article produced, but on the condition and surroundings of the producer; and in writing about such

an important body of people, it would be unjust were I to omit detailing the previous, as well as the present, state of the operatives employed.

The pottery districts have been the subject of several inquiries and investigations, official and otherwise. In 1841 a report was made by Mr. Scrivener upon the physical condition of the children, and again in 1860 by Dr. Greenhow on the excessive mortality from pulmonary disease; and lastly, the Children's Employment Commission (1862) went largely into the question. Dr. Arlidge has also written a pamphlet on the diseases of potters, to which I shall have occasion to refer. As a rule, the earthenware establishments are larger and employ more operatives than the china making, in which the work is less heavy, and the quantity of material used comparatively very small; and, therefore, according to the character of the manufacture, there is a difference in the number of workpeople and division of labour. Pottery may be divided into two departments, i. e. potting and finishing. In the former, the first operation is that of grinding the materials, such as the Cornish stone and clay, the flints, and other essentials; this being of the utmost importance to the future soundness of the ware, and usually a trade of itself. The next stage is that of "slipping," in which the clay is mixed for the use of the potters, and dried, formerly by the heat of a kiln, but now by hydraulic pressure. Not only is the fuel saved, but the workman is no longer obliged to be constantly in the hot steam of the kiln, which was very unhealthy. With the preparation of the clay begins the division into the several classes of potters, such as

"throwers," turners, handlers, hollow and flat ware pressers, tile makers, modellers, mould and "sagger" makers. All round ware was formerly made by the thrower, but things are now changed; in consequence of the present mode of pressing large pieces in plaster moulds, the thrower has to finish small things in the inside, leaving them to the turner to do the outside. As Mr. Arnoux says, in his very interesting article on Pottery,* "this is to be regretted, for the thrower was really an artist, who could impress his feeling on the work which was entrusted to him, from beginning to end." In manufactories where the thrower's wheel is not worked by steam power, he generally requires the assistance of a couple of girls, one to turn the wheel, the other to take off the ware when thrown. This is also the case with the turners. The handlers, as the name implies, fit handles to cups and jugs, &c., by pressing in plaster moulds, and bending the strips of clay in the form of handles. Boys are employed in this department, but it is not a very healthy occupation for a continuance, owing to the necessity for throwing forward their chests on to the moulds. The "flat-pressers" include the makers of dishes, saucers, plates, &c., and it is curious to note here the former requirements of juvenile labour, the dish maker usually employing one boy; the plate maker, two; the saucer maker, three; and the cup maker three, and sometimes four. Recent improvements, however, have done away with the employment of so many young lads. One chief occupation is to turn the

* 'British Manufacturing Industries.'

"jigger," or wheel, on which the workman forms the ware; but these are now frequently worked by steam power. For a long time, the flat-pressers entertained a strong objection to the jigger being turned by machinery, somewhat on the same grounds that the Sheffield grinders objected to the fans, viz. that it would tend to diminish the number of workmen; but the change has been adopted in most of the large factories. When formed, the ware has to be taken to the stove to dry. This work, which is always performed by boys, was formerly very unhealthy, as the stoves consisted of little rooms or ovens about 13 feet square and from 8 to 12 feet high, fitted inside with shelves on which the moist ware was placed. In the centre was the stove, the temperature being from 120° to 140°. As soon as the potter made the plate or saucer on the mould, the boy had to run off with it to the stove, and in proportion as the number of moulds, with which the workman was supplied, was limited, so had the heat of the stove to be raised, in order that the moulds might be more quickly dried and used again. The boy had not only to enter the stove constantly to place the moulds, but also to turn them, so that the ware might not be bent in drying. This was one of the chief causes of ill-health in the potter's business; but it has been of late largely remedied by the use of a new stove, in which the shelves revolve round a central spindle, so that, by a gentle push, each shelf is brought round in front of the opening, thus obviating the necessity for entering the stove at all. "Wedging" the clay, or beating it, so as to expel any air from it,

after it came from the hands of the slipman, used to be largely done by boys; but the new way of drying by hydraulic pressure (as explained above) has almost superseded the wedging operation. "Moulding" is a most important part of the potter's work, and, to be able to apply the same systematic pressure to all parts, requires a skilled operative. The hollow-ware pressers, who make jugs, ewers, soup tureens, &c., are said to suffer much more from asthma and pulmonary diseases than the flat-pressers, owing to the more laborious character of the work.

The ware being dried in the stoves, it is next placed in the "saggers" to be fired—the sagger being a fire-clay case to hold the ware. The fireclay of which they are fashioned, comes from the Staffordshire coal measures, and the operation of making the saggers forms a distinct division of labour, and one that requires much strength, owing to the quantity and weight of the clay. The saggers, when filled with ware, are placed in the oven to be fired, an operation which subjects the oven-men, placers, and fire-men, to great vicissitudes of temperature. This is the only portion of the manufacture which requires night-work; and it is one that demands considerable experience, so as to ensure the heat being raised very gradually and systematically. Common terra-cotta and stoneware only require one firing, but for all other wares, it is necessary to have two, so as to suit the texture of the body of the ware to the glaze on the surface, the putting on of which is the next operation after firing, if the goods are to be left white; if, however, they are to be decorated with a pattern,

they are sent to the "printing" department. Putting on the glaze or "dipping" the ware is one of the most unhealthy parts of a potter's business, owing to the poisonous nature of the glaze, of which lead forms a large ingredient. The lead is in solution, and, according to Dr. Richardson, does not enter the system by absorption, but by introduction through the mouth, the workman becoming careless and taking up his food with glaze-covered hands. In whatever way it acts, the consequences of lead-poisoning are most disastrous, inducing nausea, vertigo, and paralysis, in fact, all the symptoms of lead colic.

The decorated ware has next to go to the "printers," a process very similar to transferring to paper a design from a copper plate. Women and young girls are employed in this department, as "transferrers" and paper-cutters. There is nothing in the actual employment which is deleterious, save that the rooms are sometimes very hot and badly ventilated. The same remark may apply to the "painting" department, although the class of operatives (principally females) being of a much higher and more talented grade, we find a corresponding improvement in their surroundings. "The girls work at long tables placed under the windows, which it would be impossible for them to open for the purpose of ventilation without subjecting themselves to draughts, which would probably be more injurious to their health than even the close atmosphere which they are breathing. Female apprentice painters are generally taken from ten to twelve, but at Messrs. Minton's, not under thirteen. During the

first year they are of little use to their employers; they are paid a small weekly wage during the first three years, a certain amount of work being allotted to them according to their efficiency; they then begin to work on the piecework system, with certain deductions to the employers, as in the case of the apprentice boys." The remaining branches of employment are those of burnishing, gilding, and scouring, the latter being that of dusting and cleaning the china ware from the fine flint powder. This is done by women, and is a most unhealthy occupation, the fine but jagged dust tending to produce pulmonary disease. Mr. Scrivener * speaks very strongly about the scouring. "The particles float abundantly in the atmosphere of the room, and cover the persons of the young women as plentifully as flour does the miller: in every act of respiration, a considerable quantity is deposited on the numerous surfaces of the trachea, fauces, and bronchial tubes, and being acutely angular and irritating, soon occasions thickening of these membranes, as evidenced by their small weak voices; asthma, chronic cough, tubercular development, and consumption soon follow." The late Dr. Greenhow wrote even more strongly, and showed how, out of thirteen china scourers whom he examined, only four were in good health.

The importance of the modern improvements, which do away with so much of the "mould-running" and the "stoving" for boys, cannot be overrated. Here is a calculation showing the physical labour which had to be gone through by one of those little fellows.

* Report, 1841.

"It will appear that a good workman can, and frequently does, make eight score dozen saucers a week, each dozen containing thirty-six pieces. Each piece is carried by the boy twice to and fro, and weighs (mould and bat) 2 lb.; but as two pieces are carried at the same time, they will count but as one, and as 4 lb. on every trip. Let us first calculate the weight absolutely borne, then the distance run barefoot. Eight times 20 is 160; 36 times 160 is 5760 pieces of 2 lb. each, carried in 6 days of 72 hours, which, multiplied by 4 (the weight of 2 moulds and bats), gives 23,040 lb.; divided by 6 (the number of working days in the week), it will give 3840 lb. a day of 12 hours, without deducting the so-called one and a half hour for meals, which, by the way, they never get. The average distance from the "whirler" to the centre of the stove is an honest 7 yards; the same back will make 14; 14 times 5760 yards gives 80,640 yards, or 45 miles, 1440 yards in a week; and this divided by 6, gives 7 miles 1120 yards per day. Besides this, they have to mount one, two, or three steps, to place the pieces upon the shelves. But this is not enough, for their master requires them, while he is taking his pipe or his pot, to "wedge" the clay in the yard, and collect the half-dried pieces from the shelves: again, to come half an hour before him in the morning to get coals in, ashes out, or sweep and make ready the rooms, while he probably has to walk a mile or more from his home to his work.*" No

* "Evidence before Children's Employment Commission," First Report, 1863.

wonder that the jiggers and mould-runners were "pale, weak, diminutive, and unhealthy!"

As regards the mortality of the pottery districts, Dr. Greenhow reported, that between the years 1847 and 1855, the mortality from pulmonary diseases was 7·85 per 1000, whereas in the six northern standard districts it was only 2·97. More than half the deaths of men over twenty, in Stoke, and nearly two-fifths of those in the parish of Wolstanton from pulmonary disease, took place amongst the potters. The Registrar-General's tables of 1871 give the deaths as follows; total 528:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
1	4	19	48	44	108	119	91	62	32

And the comparative mortality:

	15–	20–	25–	35–	45–	55–	65–	75
Earthenware	·401	1·026	·708	2·009	3·367	5·804	12·847	23·370
All classes ..	·632	·859	·985	1·305	1·853	3·215	6·676	16·584

"The earthenware manufacture is one of the unhealthiest in the country. At the age of joining it is low; but the mortality after the age of thirty-five approaches double the average; it is exceedingly high; it exceeds the mortality of publicans." *

* "Supplement to Thirty-fifth Annual Report of Registrar-General," 1875.

Dr. Arlidge, the physician to the Staffordshire Infirmary, gives the following striking table, confirming the unhealthiness of the trade,* especially as regards the two first-named disorders:

	Potters (Males).	Non-Potters (Males).
Bronchitis	36·57	18·00
Phthisis	20·9	13·00
Rheumatic	7·79	21·00
Stomach disorders	8·44	19·00
Lead-poisoning	8·00	..
Cerebro-spinal diseases ..	4·32	5·00
Cardiac	2·81	6·00
Epilepsy	1·73	5·00

As compared with the surrounding population, which principally consists of colliers and iron-workers, (as far as North Staffordshire is concerned), the potters present a very favourable aspect. They are in general of clean and tidy habits, and although drinking has taken too deep a root amongst them, it is by no means so much the case as it is with their neighbours. As a consequence, they are better off and more provident, and figure comparatively seldom in the annals of crime or pauperism. The pottery district obtained a very bad name a year or two ago through a ridiculous and sensational man-and-dog-fight story, the truth of which never seems to have been brought home. The statistics of the police at Stoke, Hanley, and other places, however, show that the district is unusually quiet and well-behaved for a large manu-

* 'On the Diseases prevalent among Potters,' 1872.

facturing population. The wages, according to the Factory Returns of 1871, were:

Throwers	24*s.*	to 36*s.*	per week.
Turners	26*s.*	„ 28*s.*	„
Hollow-ware pressers	30*s.*		„
Flat-ware pressers	30*s.*		„
Printers	24*s.*	„ 30*s.*	„
Oven-men	28*s.*		„
Sagger makers	30*s.*	„ 36*s.*	„
Mould runners	4*s.*	„ 4*s.* 6*d.*	„
Biscuit fire-men	29*s.*	„ 31*s.*	„
Dippers	32*s.*		„
Slip makers	30*s.*		„
Transferrers	12*s.*	„ 20*s.*	„
Painters (women)	10*s.*	„ 14*s.*	„
Glost (or glaze) fire-men	26*s.*	„ 31*s.*	„
Jar makers	8*s.*	„ 9*s.*	„

and in 1876:

Labourers	18*s.*		„
Stokers	24*s.*		„
Millers (flint and colour grinders)	50*s.*	„ 80*s.**	„
Slip makers	21*s.*		„
Clay press-men	30*s.*	„ 36*s.**	„
Modellers	42*s.*	„ 63*s.*	„
Mould makers	40*s.*	„ 50*s.**	„
Throwers	40*s.*	„ 60*s.*	„
Turners	30*s.*	„ 40*s.**	„
Hollow-ware pressers	24*s.*	„ 42*s.**	„
Flat-pressers	28*s.*	„ 35*s.**	„
Sagger makers	35*s.*	„ 45*s.**	„
Handlers	30*s.*	„ 35*s.**	„
„ (women)	14*s.*	„ 20*s.**	„
Placers	30*s.*		„
Fire-men	45*s.*	„ 60*s.*	„
Biscuit warehouse-men	30*s.*	„ 40*s.*	„

* Piecework.

Under warehouse-men ..	24*s.* to 26*s.* per week.
Warehouse-women	7*s.* „ 10*s.* „
Parian figure makers ..	30*s.* „ 42*s.** „
Engravers	35*s.* „ 42*s.* „
Printers	32*s.** „
Transferrers	15*s.** „
Hardening-on kiln-men ..	30*s.* „ 40*s.* „
Dippers	36*s.* „ 46*s.** „
Glost warehouse-mon ..	35*s.* „ 50*s.* „
Under „	25*s.* „ 35*s.* „
Sorters (women)	7*s.* „ 10*s.* „
Artist designers	60*s.* „ 120*s.* „
Painters	42*s.* „ 63*s.* „
„ (women) and liners	14*s.* „ 20*s.** „
Gilders	24*s.* „ 36*s.** „
Burnishers	8*s.* „ 10*s.** „
Ground-layers	55*s.* „ 65*s.** „
Stencillers (women)	21*s.* „ 23*s.** „
Enamel kiln-men	30*s.* „ 45*s.** „
Packers	29*s.* „ 30*s.** „
Foremen	35*s.* „ 50*s.* „

* Piecework.

These particulars suppose throughout, competent workpeople, constant work, steady habits, and a manufactory of respectable position in the trade.

As regards legislative progress, the earthenware trade comes under the Factory Extension Act of 1864, which in that year was applied to this branch of employment. The manufacture of bricks and tiles, however, is under the Factory Extension Act of 1867 and the Workshops Regulation Act of the same year.

Nothing shows the anomalies of our working-class legislation more than the condition of things in the Potteries; for not only are these kindred trades, alike in all their main features, under three different

Acts, but matters are still further complicated by the proximity to the coal-fields, which make a fourth and separate division of official cognizance. A boy may work in a coal mine at twelve years old; but he may not go into the adjoining pottery and work there until he is thirteen, except as a half-timer. The inconsistency would be almost comical, were it not an enormous inconvenience, for it has the effect of causing the half-timers to work until they are twelve years old, and then abruptly leave for a colliery, thus creating a deficiency of juvenile labour at the pottery, and a sudden interruption of working arrangements. The same confusion takes place in the schools, for the required hours of education are different in the Factory and the Coal Mines Regulations; and thus the two arrangements are always clashing with each other and giving needless trouble to all parties, from inspectors downwards.

Our exports of earthen and china ware, Parian and porcelain (except red pottery and brown stoneware), were as follows:

	Value.		Value.
1867	£1,635,216	1872	£1,990,783
1868	1,642,550	1873	2,048,872
1869	1,778,539	1874	1,738,340
1870	1,637,026	1875	1,745,078
1871	1,731,483		

our best customers being the United States; Germany takes most brown ware.

In 1875 the exports were in value:

Red pottery and brown stoneware ..	£106,642
Earthenware and china	1,752,324

Our imports were in :

	Value.		Value.
1870	£150,437	1873	£340,499
1871	176,307	1874	323,507
1872	237,467	1875	336,666

II. Tiles.

The manufacture of plain and encaustic tiles is so far important in this country, that I cannot omit mention of it, although it practically belongs to the pottery class, or more strictly speaking, holds a middle place between pottery and brick making. Many brick makers manufacture tiles, though the encaustic process is a speciality belonging to a few firms, foremost among whom may be mentioned Herbert Minton and Hollins, of Stoke-upon-Trent, and Maw, of Broseley. The process is very simple, the plain tiles being composed of dry clay powder, subjected to a great pressure while in metallic moulds. The encaustic tiles are made from clay in which the design is sunk below the surface, so as to allow of the different colours being poured in as required. When hard, the tiles are scraped, and show the coloured design. The conditions under which the manufacture is carried on are so similar to those of pottery, that they do not require special mention.

III. Bricks.

The manufacture of bricks and draining tiles employs a very large population throughout the kingdom, and perhaps gives more steady occupation (albeit it is a "season" one) than almost any trade; for even in times of great depression, such as in the present

year (1876), building and draining appear to be as flourishing as in more prosperous years. The Census tables give a total for England and Wales of 36,249 males and 2530 females, of the respective ages as follows:—

	5–	10–	15–	20–	25–	35–	45–	55–	65–	75
Males ..	86	3084	4663	4644	8179	6708	4811	2562	1156	356
Females ..	11	494	1052	440	262	120	76	45	19	11

by which it will be seen that brick making is eminently a juvenile employment. Whether it is fitted or not to be so is another question; but the fact remains, that the brick-fields are always swarming with young lads, and occasionally girls. For the latter it certainly is not an advisable occupation; not that it is unhealthy for those who can stand exposure to the weather, but that it is too heavy for the feminine physique, while the associations of a brick-field are not such as a young girl should be brought up in. The Census Returns are rather above those of the Factory Returns of 1871, which gives the following table of brick and tile factories under that supervision:

	No. of Brick-works.	No. of Children under 13.	Males up to 18.	Males above 18.	Females.	Total.
England ..	1630	1162	4520	12,815	1443	19,940
Scotland ..	168	47	375	1,722	318	2,474
Ireland ..	18	59	107	336	46	493
Total ..	1816	1268	5002	14,873	1807	22,907

When these returns were made, however, the brick-yards had not properly come under the Factory Department.

The principal localities for brick making are in the counties of Kent, Somerset, and Stafford, being in fact those counties where the most extensive and suitable beds of clay are found; but indeed it is a very general trade throughout the country, and scarcely a town of any size, but has (under favourable circumstances) a brick-yard adjoining it. In Kent alone, the brick-fields, in the neighbourhood of Faversham and Sittingbourne, extend for miles, as far down as the mouth of the Medway, and again up that river to Maidstone; and a population of between two and three thousand persons find work in them. The following description of a brick-field is taken from the Factory Report of 1872, graphically given by Mr. Sub-Inspector Whymper: "Dotted about some great tawny flat, which stretches perhaps for miles down to the misty waters of the Swale or Medway, stand the huts or 'stools,' in or round which the greater part of the juvenile labour is carried on. Each of these is practically a separate factory, in which the gang, possibly made up of his own family chiefly, is hired, paid, and controlled by the 'moulder.' He, in his turn, receives so much per thousand for the bricks, and has to get his profit as he can. . . . . Go to the brick-field on a fine day, when the 'stools' are at work, and a feverish activity will be seen to inflame the 'brickies.' Here sunburnt men, whose scant clothes are of much the same colour as their skins, desperately run their top-heavy barrow-

loads hour after hour under a perhaps almost tropical sun; there, the little 'barrow-loader' (happily now no longer a child of seven or eight years old) ceaselessly swings himself from leg to leg, as he lifts his tale of bricks upon the barrow; while that other worker, who, by her length of draggled skirt should be a woman, claims no exception on account of her sex, but rough-shapes the lump of clay and supplies the moulder next her, as if he were an insatiable machine, and not a creature of flesh and blood. On a wet day all is changed. The huts are empty, and the tools of the work lie about unused. Not a brick is being made, and not a soul is to be seen. Anything more desolate than a large brick-field on a wet day it would be difficult to imagine."

Simple as is the appearance of a brick, it is surprising how many divisions of labour are occupied on it. There are two kinds of hand-making of bricks, differing according to the character of the clay bed, viz. "slop" moulding, which is principally found in Lancashire and the Northern districts, and "sand stock" moulding, which ordinarily prevails over the London clay areas. In most of the large brick-fields, machinery is in use, which dispenses with a considerable portion of juvenile labour; but it is by no means universal, and I shall describe the hand-making process first of all, pointing out the stages where the machinery has stepped in. The "moulder," who is at the head of the gang, and who, when he can, employs the members of his family, stands at his "stool," with the "walk-flatter" by his side. This is a girl or woman,

probably his daughter or wife, from whom he receives a lump of clay sufficient to make a brick, she having first of all given it a hasty wedge-like shape. The clay is brought up from the pit or bed, by a workman called the "temperer," who wheels it to the "pug-mill," on emerging from which, enough is cut off to make three or four bricks by the "pug-boy," who then carries this lump to the "walk-flatter," to be passed on by her to the moulder. The pug-mill, when not worked by steam, is turned by horse-power, and formerly it usually stood a considerable distance from the moulder's stool, so that the little pug-boy, always very young, had to carry the load by supporting it against his chest. Now, however, the pug-mill is generally placed close to the moulder, and is self-delivering, in which case the services of the pug-boy are dispensed with. It is not so, however, always, for Mr. Lakeman, a Sub-Inspector of Factories, writes in 1872: "Pug-mills are not general in Essex and Suffolk, the earth being trodden by children, who are kept at work tempering a heap of clay from morning to night; they also serve the makers with clay, being obliged to lift quantities nearly equal to their own weight; they must also wheel away the bricks and place them on the 'hacks.' I have seen double-made barrows capable of taking off fifty bricks at a time; this load is wheeled away by two children, one in the shafts, the other a leader, pulling along with a rope. In a large work in Suffolk, I found a child, puny and half fed, about nine years old; he had to load a barrow with stiff unworked clay, then wheel it to a grinding machine: so he went, to and fro, har-

nessed like a little donkey. I took the barrow, wheeled it some distance, then asked the foreman to do the same. I affirm that the barrow was such as men use, that it was full, that it was a heavy load for me, and that the foreman admitted it was a heavy load for him." *

The moulder flings the clay which he has received from the flat-walker into his mould, and empties it on to a pallet board by his side, called the "pago," and from thence it is lifted off by a boy called the "barrow-loader," to the amount of some twenty to thirty bricks, and placed on a light cart or barrow. The "pusher out" wheels it away to meet the "off-bearer," who places the bricks, or "skintles" them, in the "hacks" to dry. The introduction of brick-making machinery, such as Clayton's, or Bawden's, has largely modified the moulder's duties, and enabled him to do without the flat-walker and the pug-boy. Two men, or a man and a boy, are sufficient to attend to the machine, the bricks, after being turned out, being treated as before. After the bricks are sufficiently dried, they are taken off to the kilns by the "crowder," who delivers them to the "setter" to be burnt. It will be seen, therefore, that although a great many, comparatively speaking, are employed in the manufacture of a brick, the work is heavy and fatiguing, principally owing to the unyielding nature of the material. It is, moreover, one that is exposed to the action of all weathers, although a wet day is generally a *dies non*, as not being suitable for brick

* Factory Reports, 1872.

making. Previous to the including of brick-fields under the Factory Act, the hours were unreasonably long, and the age of the children employed inhumanly early, so much so, that it was a common saying that "a moulder's child is born with a brick in his mouth." Evidence was given before the Children's Employment Commissioners, in 1862, that the hours of work for children were from 5 A.M. to 8 or 9 P.M., most of these little victims being not more than eight or nine, and some as young as six. Here was a case in point, relating to a pug-boy eight years old: "He was working here last summer; he could scarcely speak plain then; 'tis but an infant, as you may say, even now, and my wife used to say, it made her heart ache to see the poor little fellow. I hear him going up with his horse at four or five in the morning, singing as he goes by my cottage, and he doesn't get home again till 8 or 9 P.M., and in the long summer days not till 10." Then the little barrow-loaders, who were frequently young girls, had to lift loads as much as a man could do, perhaps twenty-five tons or thereabout in the course of a day's work, and if the ground was saturated with rain, the labour was proportionately heavier. It was fortunate indeed, for the interests of humanity, that the Legislature at last undertook the supervision of the brick-fields, and afforded the much-needed protection to these poor children. At present brick-yards come under the Factory Act of 1867, the Workshops Act of the same year, and the Factory and Workshop Amendment Act of 1871, which prohibits the employment in this occupation of females under

sixteen, and children under ten, except when the tiles made are ornamental ones. It is very satisfactory to know that, even amidst these rough operatives, the effect of the supervision has been of the happiest kind. Overwork has been substantially checked, while very young children can no longer be employed with impunity; and although, doubtless, the inspectors have had a hard battle, to see that the law is properly carried out, there is a marked decrease, according to the latest reports, in the rough manners and defiant attitude of the workmen. Brick makers have been so long neglected, that it will take a considerable time ere they lose their character for ignorance and brutality; and even as lately as 1873, Mr. Lakeman quotes (speaking of his district in the east of England): "A most barbarous, semi-civilized, ignorant set. Men and boys look like Red Indians, the sand used in brick making being burnt red, with which their bodies are covered, working bareheaded, barefooted, with exposed breasts, and wild looks. Drinking all day Sunday, Monday and Tuesday, dog and man fighting. They resume work on Wednesdays, when the poor little unfortunates are made to toil away, stamping and carrying, and pressing a good fortnight's work into three or four days. One man, who last week earned in four days 28*s.*, took his wife home a loaf of bread and 6*d.*" * In truth, the desire for drink is one of the worst features of the brick-yard, and with it, of course, comes the waste of half the subsequent week.

With respect to *wages*, brick making, during the

* Factory Reports, 1873.

season, is decidedly remunerative. The moulder usually works under an agreement for a yearly hiring, and he hires a gang under him, the members of which are paid by the piece, viz. so much per 1000. As stated before, some of the gang are usually of his own household; but even where they are not, it is the custom for the moulder to provide board and lodging in his hut. Under these circumstances, it may easily be imagined that cleanliness and decency are the last things thought of. A hand-maker of bricks ("sand stock") will make, in the season of twenty weeks, some 500,000 bricks, or at the rate of about 25,000 in a week of 45 hours. "By the Union tariff, the sum obtained by the moulder from the master is now (1873) 9*s.* per thousand of bricks, which is thus distributed:

	s.	*d.*	
Moulder	2	4	per 1000
Temperer	2	4	„
Wheeler	2	3	„
Carrier off	1	0½	„
Waller	1	0½	„

Thus the earnings have been: Moulder, 2*l.* 18*s.* 4*d.* per week; carrier off, 1*l.* 6*s.* 1*d.*; waller, ditto. One case of a moulder I knew, who turned out 620,000 bricks in the season. His son, aged fourteen, carried them off, and his daughter, aged seventeen, walled them; a second daughter of nineteen working at another stool. The net earnings of this man weekly, and his three children, amounted to 8*l.* 7*s.* 2½*d.* This, however, was an extreme case." *.

* Factory Reports, 1873: Bignold on the Manchester Brick-fields.

According to the Factory Returns of 1871, the average weekly earnings of brick-yards in Kent were:

Moulders .. .. 27*s.*
Sorters and loaders .. .. 25*s.*
Barrow-men .. .. .. 18*s.* to 21*s.*

and in the present year (1876), I see by the 'Labour News' that the price is 6*s.* 3*d.* per 1000 bricks.

Brick making cannot be said to be an unhealthy trade, except when pursued under the unfavourable circumstances before detailed. But for the fact that it is carried on almost entirely in the open air, and that the clay itself is of a damp, retentive character, giving a great opening for rheumatic complaints, there is nothing in the manufacture itself to cause illness or more than usual mortality.

The Registrar-General's Returns for 1871 are as follows:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
1	2	26	34	76	72	80	84	79	94

which certainly betokens no tendency to premature decay.

I have no means of calculating what is the present production of bricks in this country; but it must be enormous. Mr. Lakeman in his report as Factory Sub-Inspector for Essex, Suffolk, and Norfolk (1873) speaks of "500 ascertained fields," and the known number under the care of the Sub-Inspector's districts of Mr. Redgrave's division to be 1816. In the year 1858 an effort was made by the authorities conducting

the mineral statistics to tabulate the brick-yards and the quarries of the United Kingdom; but after the issue of one volume the publication ceased.

As the only estimate in existence, I give this one of 1858,* which is a table of the quantity of bricks, tiles, and draining pipes, &c., manufactured in that year:

	No. of Works.	No. of Bricks, &c.	Value.
			£
Cornwall	15	5,900,000	6,490
Devonshire	40	26,250,000	28,875
Dorsetshire	70	71,500,000	78,650
Somersetshire	37	72,875,000	80,160
Gloucestershire	70	84,500,000	92,950
Wiltshire	54	68,500,000	75,350
Hampshire	80	62,300,000	68,530
Isle of Wight	17	67,500,000	72,250
Sussex	24	77,550,000	83,305
Surrey	46	75,000,000	83,050
Kent	41	68,750,000	72,325
Middlesex	27	107,500,000	118,335
Berkshire	35	42,350,000	46,585
Essex	44	80,000,000	88,000
Suffolk	58	84,000,000	92,400
Norfolk	114	75,000,000	82,000
Cambridgeshire	18	69,000,000	75,900
Hertfordshire	18	27,500,000	30,250
Buckinghamshire ..	24	35,500,000	39,500
Oxfordshire	19	54,500,000	59,950
Bedfordshire	10	29,000,000	31,900
Huntingdonshire ..	18	24,750,000	27,255
Lincolnshire	23	75,500,000	83,050
Northamptonshire ..	24	58,250,000	64,075
Warwickshire	107	75,000,000	94,375
Leicestershire	21	54,000,000	67,500
Nottinghamshire ..	56	64,500,000	80,625
Derbyshire	87	74,000,000	92,500
Staffordshire and Worcestershire	270	100,000,000	125,000

* Mineral Statistics. Building Stone Returns, 1858.

IV. Clay Workers.

Amongst the workers in clay, I must not omit reference to those operatives in Cornwall and Devonshire, who raise the china clay or kaolin for the china factories at the potteries; also the blue or ball clay from the tertiary clays in the neighbourhood of Poole and Wareham. A considerable population is employed upon these special deposits; but I am not aware of anything in connection with them, which differs from the ordinary clay digging. The Cornish clay workers in the neighbourhood of St. Austell get from 15*s.* to 20*s.* per week of 48 hours (1876). The following is the production of kaolin and china stone for the last ten years:

	Kaolin.	China Stone.
	tons.	tons.
1865	97,750	25,500
1866	105,000	35,000
1867	127,000	33,500
1868	100,000	29,000
1869	105,700	28,500
1870	110,520	32,500
1871	125,000	33,000
1872	141,000	48,000
1873	153,000	45,000
1874	150,500	42,500
1875		

The total yield of clays and stone for 1874 was:

	Tons.	Value.
		£
Porcelain clay and stone ..	226,309	212,165
Potter's clay (Devon)	59,789	29,894
„ (Cornwall).. ..	1,818	1,350
Ball clay (Poole)	79,205	19,800

The fireclays of the coal measures play a very important part in the industries of the kingdom, and deserve mention. Most of the fireclays are worked together with the coal seams, and in these cases the operatives are subject to the same conditions of labour as coal miners. In some districts, however, as at Stourbridge, a special kind of clay is dug, particularly in request for making pots for the glass-houses and for gas retorts, the consumption of "pot" being 12,000 or 13,000 tons per annum. Women are largely employed in the Stourbridge district, breaking the clay in pieces, and throwing on one side all discoloured and irregular lumps. The average earnings are about 25*s.* a week. The total amount of the fire clays derived from the various coal-fields in the United Kingdom in 1874 was 2,067,791 tons.

V. Quarrymen.

As in the case of bricks and clays, there is no more recent official statement of the number of quarries in the United Kingdom than the one of 1858, the sum total of which is thus given:

	Number.	Yield.	Value.
		tons.	£
England	1,504	7,500,000	1,705,508
Wales	158	3,500,000	898,123
Scotland	678	4,750,000	1,211,393
Ireland	..	..	800,100

It is to be regretted that there is no later summary of this industry, which is not only of the utmost importance to the country from the variety and value of

the building stones, but gives employment to such a large body of men, viz.:

	Under 20.	Above 20.	Total.
Stone quarrier	3,590	22,091	25,681
Stone cutter or dresser ..	809	5,240	6,049
Slate quarrier	2,196	7,597	9,793
Limestone quarrier ..	700	4,494	5,194

Professor Hull, in his article on Building Stones,* has given so full a description of the sources from whence are derived our supplies, and of their different qualities, that I need only refer my readers to it. The nature of the work differs of course according to the formation of the strata, or the hardness of the material to be quarried; and there are certain dangers to which all quarrymen alike are subject, such as those incurred by falls and slips of rocks, or from blasting. When accidents do happen from the latter cause, they are usually bad ones. Injuries to the eyes too are of frequent occurrence, from the chips of stone which are constantly flying about.

Slate quarries or mines, however, demand a little more attention. Our great storehouses of slates are the north coast of Cornwall (Tintagel and Delabole), Cumberland, and North Wales, the largest and most valuable quarries in Great Britain being situated in the ranges of mountains in the neighbourhood of Llanberis, Bangor, and Festiniog. For many years the quarries in the latter district have been worked

* 'British Manufacturing Industries.'

by open work, but the excavations became so deep, that the overlying masses were a source of danger to the men and of loss to the proprietors, and it then became necessary to drive underground levels, and mine the slate just as though it were coal, the blasting being done by skilled workmen called "rock-men." These rock-men work in partnerships extending from pillar to pillar, and styled "bargains." Mr. Evans, the Metalliferous Mine Inspector for Wales, whose duties include also slate mines, in his report for 1875, gives a melancholy picture of the sanitary condition of the North Welsh miners. The average age at death of the Cornish metal miners is low enough, but that of the Welsh slate quarriers is still lower. Mr. Evans tells us, that the average age of the males who died in the sub-district during the year was 49·32 years; the average age at death of the males not employed at the slate quarries was 67·12 years, but that of the males employed in the slate was 37·78 years, proving apparently that the workman in the slate mines sacrifices 29·34 years of his life, in obtaining a higher rate of wage than the neighbouring agricultural labourer. The only reason for this melancholy state of things appears to be the frightfully unsanitary condition of the villages, and the quarry-men's homes, in which typhoid and other fevers appear to find a permanent abiding place.* Where stone or slate is obtained from underground, the place becomes a mine, in the official acceptance of the word, and is then under the cognizance of the mine inspectors.

* 'Coal Mines Inspectors' Reports,' 1875.

As quarries, they are under no supervision, although it is a moot point whether, under certain circumstances, they are not under the Workshops Act. A case was tried of a slate quarry, where more than fifty persons were employed under sheds in splitting slates, it having been held that such a place was a factory; but it was decided in the negative. There is no doubt, however, that quarries ought to be placed under inspection, with as good reason as mines.

The Registrar-General's tables for 1871 give the following results:

	5–	10–	15–	20–	25–	35–	45–	55–	65–	75
Stone quarrier	..	..	11	34	64	88	104	105	84	39
Stone cutter	..	1	..	12	18	18	27	25	20	8
Slate quarrier	..	1	12	28	27	23	21	23	18	16
Limestone quarrier ..	..	..	5	2	6	15	14	24	22	16

As far as the Mine Inspectors' Reports embrace quarry mines, the following is the yield for 1875:

		Tons.
Black marble ..	Derbyshire	20
Building stone ..	Renfrewshire	68,000
„ ..	Somersetshire and Wiltshire	76,667
Flagstone	Lancashire	48,000
Ganister	Lanarkshire	750
Limestone	Scotland	92,653
„ ..	Wales and Salop	12,500
„	Lanarkshire	165,262
„	Lancashire	3,884
„	South Staffordshire ..	224,728
Slate	Wales	149,565
„	Westmoreland	2,623
„	Ireland	794
Whinstone ..	Northumberland	1,729
, ..	Durham and Yorkshire	9,733

VI. Glass Works.

The glass industry is of great numerical and commercial importance, employing (1871) 18,344 males and 1737 females. The ages of the former are given as follows:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
6	1646	3392	2959	4338	2890	1777	950	327	59

by which the trade seems to be one of early life. There are, indeed, very few occupations which show such numerous varieties as those in which glass is manipulated; for even in the actual production of the raw material, some four or five kinds of glass are made, all of which differ materially in the processes of manufacture and the conditions of the operative. The Factory Returns of 1871 show the number and locality of the glass works to be:

	Number.	Children.	Males up to 18.	Males above 18.	Females.	Total.
Durham ..	24	10	1,113	2,153	401	3,677
Lancaster ..	37	6	1,530	3,602	927	6,065
Middlesex ..	16	4	134	319	30	487
Northumberland	9	7	117	277	23	424
Somerset ..	1	..	70	243	6	319
Stafford	33	1	808	2,755	312	3,876
Surrey	9	..	86	136	5	227
Warwick ..	47	3	274	874	167	1,318
Worcester ..	8	2	56	131	7	196
York	29	12	877	1,961	138	2,988
Scotland ..	19	1	464	1,037	91	1,593
Ireland	8	..	63	192	9	264
	240	46	5,592	13,680	2,116	21,282

In addition to these there are (principally in the county of Warwick) thirty-seven glass-cutting factories, employing 500 people. The four main branches of the glass manufacture are those of plate, crown and sheet, flint, and bottle glass, all of which have their varieties and subdivisions. The chief localities are the Tyne and Wear, for flint (blown and pressed), also plate; St. Helens, plate; Birmingham and Stourbridge, plate, crown, and sheet; Castleford, bottle; London, plate, flint, &c. It will be understood that glass making, or the work of the "glass-house," is one thing, while glass finishing is another, involving what may be called separate and subsidiary occupations, such as polishing, cutting, ornamenting, painting, embossing, &c. It is with the glass-houses chiefly that we have now to do. Professor Barff has dealt so ably with the subject of glass in his article,* that I need only mention the varieties of the employments, in so far as they affect the work-people. The plate glass, as is well known, is made chiefly for smooth surfaces, as mirrors and windows; crown and sheet, for ordinary window glass; flint, for ornamental work where diversity of form is required, such as lamps, table glass, medical and perfumery glass; while bottle is used for wine, beer, pickles, and all other classes of those useful articles, the bitter-beer trade alone employing a large population in providing bottles for it.

In flint-glass houses, the men and boys work in sets or "chairs" of four, viz. the head-man or "work-man,"

* 'British Manufacturing Industries.'

the "servitor," the "foot-maker," and the "taker-in;" all these operatives varying in age from the head-man downwards, and the two latter mostly being boys. In bottle houses the arrangement is different. The set is called a "hole," from their all working at the same furnace mouth or hole, and consists of the bottle maker or "finisher," the "blower," the "gatherer," the "putter-up," and the "taker-in." The latter, always boys, carry the articles, the moment that they are made, from the glass maker to the annealing kilns, but they are not considered as "attached" to the trade. They also help to clean the irons for the men, and do other odd jobs. Boys are employed in crown-glass houses (which are comparatively few in number) as "pushers," or sliding back the iron door of the furnace after the glass is drawn out; and in the sheet-glass houses, they push the cylinders into the annealing kilns. Others hold shovels before the mouths of the furnace to screen the faces of the "gatherers" from the intense heat, prepare clay or "dabby" for arranging the pots, and help in the polishing of the plates or sheets, by throwing on sand or polishing powder. Women and girls are not now employed in the glass making itself, though they were until lately in the black bottle manufacture, where they drew them out from the arches or annealing kilns; but they help in the stage of polishing plates, called "smoothing," and also in cutting, roughing, or obscuring glass for lamp globes, &c. Painting and enamelling afford occupation of a higher grade for others. Foot-makers are mostly apprentices learning the trade,

though for best work, journeymen foot-makers are generally engaged. A foot-maker does not expect to be promoted to be a servitor, until he has been at work at the trade many years, and a workman is usually advanced in life before he has attained that position. The following account of the routine of the work in a glass-house is taken from the evidence of a witness before the Children's Employment Commission,* premising that the hours of work are necessarily peculiar, depending on the length of time that it takes to prepare the quantity of metal which it is considered feasible to work out at one time. These working processes are called in glass-house *parlance* "journeys": "The first journey begins soon after twelve on Sunday night, because, if time is lost in the course of the week, it cannot be fetched up. The whole period required for preparing and working out one melting of metal may be put on an average at forty-two hours. Of this two or three hours are taken for preparing the furnace, twenty for founding, eight for settling, and nine or ten for working out the metal. The hours are much the same in both the crown and sheet work, except that, of the two, the working journey is rather shorter in the sheet."

Glass-houses, as a rule, are not such very hot places of work, except of course where the operatives are close to the furnace. In old houses, where the furnace and kilns are crowded, or where the chief communication with the open air is only through the

* Children's Employment Commission. Fourth Report, 1865.

chimney cones, the ventilation is very contracted and the heat is very great; but many of the modern houses are both cool and light. The amount of heat differs too with the kind of glass made, crown and sheet houses having larger openings to the furnaces and dealing with bigger masses of metal, than flint-glass works. There is in most houses, too, much dirt and dust flying about; and in some of the bottle works, arsenic is used, and in flint-works, lead, as ingredients in the materials, both of them tending to the unhealthiness of the employment. The hottest part of the operations is felt by the men who have charge of the metal and furnace during founding, before the actual glass making begins. The following is the temperature given in various parts of the house: At the mouth of the furnace, from 172° to 220°; place where the blowers stand, 95° to 118°; where the boys "take-in," 80° to 196°. Both shovel holders and takers-in work in a tremendous atmosphere; and so, though in a less degree, do those boys who work in the "arches," which are kilns or ovens, something like wine-bins, where the bottles are cooled down. The "takers-in," or the boys who take the glass from the blower to the kiln or arch, which is usually from 12 to 16 yards distant, have as hard work comparatively as any of the operatives. The weight of each article of course varies, but practically it is added to by its being held at the end of a pole several feet long. This is necessary on account of the heat of the bottles. The weight of a common quart bottle is about 1 lb. 9 oz., or 19 lb. to the dozen, and

in a fair "journey" ninety dozen are "taken in," making more than 15 cwt., or in some fuller journeys about a ton. The pipes carried in sheet and crown houses also weigh from 16 to 20 lb., boys sometimes carrying two of the latter weight at a time. The distance that is traversed depends very much on the number and the rapidity of make of the articles. When small things are blown, such as medical bottles, at least fifteen gross, or 2160, would be made in a day; so that, taking the minimum of 12 yards to the arches, the carrying of fifteen gross would require the boy to walk about 15 miles. In the Sheffield bottle works, the "number" or the basis upon which the wages are calculated, varies according to the size of the bottles: for pints and quarts being 63 dozen, while for small bottles it is 70 dozen. For all below the "number" the men are paid a certain price, and for all above it a slightly increased price, the quantity of bottles made above the number being termed the "plus." The operation of "blowing" is said to develop affections of the chest, and, from the constant exertion, the muscles of the cheek sometimes become strained and relaxed, so that the cheeks, during the blowing, swell out like great balls. On the other hand, exhaustion is partly made up by complete rest on Saturdays and Sundays, and not unfrequently on Fridays and Mondays also, thus giving two whole days, and sometimes three, for rest each week. The glare and the heat, of course, tell more or less upon the workpeople, and especially upon the boys, who are generally slight and small for their age, with pallid complexions. Burns of various

degrees are so common, that they are almost the rule. Intemperance is a sadly prevalent vice amongst glass makers, and it no doubt adds a good deal towards the unhealthy tendencies of the work in those who are addicted to it. In truth, the temptation must be very strong, and even the boys are in the habit of drinking large quantities of water, which frequently causes chills.

Glass-cutting is an unhealthy trade, not only from its being sedentary, but on account of the irritating dust arising during the polishing stage, which plays great havoc amongst those engaged in it.

Few trades required supervision more than that of glass making, and it is now under the Factory Extension Act of 1867, which provides that no boy under the age of twelve, and no female, shall be employed in any part of a glass factory in which the process of *melting* or *annealing* glass is carried on, and also that no child, young person, or woman shall be allowed to take his or her meals in any part of the factory where the materials are mixed, or in the manufacture of flint glass, where the work of grinding, cutting, or polishing is being performed. From the nature of the trade, night-work is a necessity, just as it is in blast-furnaces and iron-mills. The tables of the Registrar-General show the number of deaths in 1871 to have been 299, viz.:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
..	1	10	23	56	45	49	54	46	15

Compared with all ages, the ratio of mortality is:

	15–	20–	25–	35–	45–	55–	65–	75
Glass	·298	·670	1·180	1·527	2·160	4·467	12·395	28·902
All ages ..	·632	·859	·985	1·305	1·853	3·215	6·676	16·584

"Among the glass manufacturers, the mortality is higher at 25–35 than amongst the earthenware makers, but much lower afterwards."

The wages in 1871 were as follows:

Founders ..	36*s.* 10*d.*	Boys (grinders) ..	8*s.*
Spare-men (to fill the crucibles)	36*s.*	Smoothing	30*s.*
Kiln-men	35*s.*	„ (women)	10*s.*
Cutters	35*s.*	Polishing	35*s.*
Grinders	38*s.*	„ (boys) ..	10*s.*

In 1876 a "work-man" made 2*s.* 5*d.* to 3*s.* 9*d.* per 'move.'
„ a "servitor" „ 1*s.* 11*d.* to 3*s.* „
„ a foot-maker „ 1*s.* 2*d.* to 1*s.* 7*d.* „
„ a boy „ 5*d.* to 7*d.* „

In the Birmingham districts glass makers usually work fourteen, sixteen, or eighteen moves per week. In glass-cutting the wages average from 25*s.* to 35*s.* per week of fifty-four hours. Glass engraving and etching is more remunerative, and those who work at it can make 3*l.* or 4*l.* per week. The operatives work by the piece, and in their own shops, having their own apprentices. Women, working at roughing, cleaning, &c., earn from 6*s.* to 10*s.* per week.

The exports of glass from Great Britain were:

PLATE, ROUGH OR SILVERED.

	Amount.	Value.
	sq. ft.	£
1870	1,357,508	145,509
1871	1,643,575	159,965
1872	2,124,697	243,353
1873	2,183,106	328,699
1874	1,411,268	315,605
1875	1,609,662	211,307

FLINT OF ALL KINDS.

	cwt.	
1870	107,942	290,174
1871	106,648	258,165
1872	113,497	300,684
1873	124,160	328,699
1874	101,762	215,605
1875	104,848	211,037

BOTTLE AND GREEN GLASS.

1870	614,288	306,763
1871	650,225	315,825
1872	760,708	473,056
1873	907,886	461,918
1874	890,822	463,626
1875	602,795	366,695

Our chief customers are, for plate, including looking-glasses, the United States and Australia; for flint, Australia; for common bottles, Australia, America, and Bengal; Portugal also takes a great many of the latter.

Our chief source of import is Belgium, for window,

and sheet, flint, and plate glass; although France, Holland, and Germany also supply us with some.

IMPORTS IN 1875.

	Cwt.	Value.
		£
Window glass ..	69,167	77,988
Flint ,, ...	52,934	57,682
Plate ,, ...	9,178	31,407

CHAPTER VI.

DECORATIVE METAL WORK.

I. Watches and Clocks.

This is another curious example of localized trade, London (Clerkenwell), Coventry, and Prescot, in Lancashire, engrossing nearly one-half of the population engaged in it. The Census tables give the following estimate:

	Total	5–	10–	15–	20–	25–	35–	45–	55–	65–	75
Males ..	20,693	2	480	2,706	2,643	5,317	3,542	3,071	1,791	822	319
Females ..	580	..	28	130	87	106	83	74	45	24	3

Of this number London possessed 4789, and Lancashire 3038.

The Factory Returns throw no light upon these numbers, giving only six factories for England and Wales, employing three hundred and eighty-five persons; but it must be remembered that clock and watch making is a solitary occupation, employing only the owner of the shop and perhaps another, and that consequently it does not come under the Factory or Workshops Act, which latter requires a minimum of five workers. Upon the trade, as bearing upon the health of the operatives, there is really very little to be said. The watch maker, from the nature of his work, is

usually a thoughtful, quiet man, whose whole life is spent in the contemplation of minutiæ. The occupation is subject to the same sanitary conditions as most sedentary industries, although diseases of the eyes are rather prevalent, owing to the concentration of the sight on small objects by the light of a strong gas flame. The conditions of labour out of London—as, for instance, Lancashire—are somewhat different. At Prescot, near Liverpool, there are at least forty distinct branches of the watch-making trade carried on, the manufacture of each of the numerous parts of which a watch consists being a separate art, so that an apprentice in one branch of the trade does not necessarily learn anything of another branch. In Kelly's Trade Directory I find the following list of various callings connected with watches, most of which are to be met with at Prescot:

Watch makers.
„ engravers.
„ examiners.
„ gilders.
„ jewellers.
„ jobbers.
„ balance makers.
„ barrel makers.
„ barrel ratchet makers.
„ bolt makers.
„ compensation makers.
„ detent makers.
„ case enamellers.
„ „ joint finishers.
„ escapement makers.
„ lock makers.
„ file makers.

Watch frame makers.
„ fusee makers.
„ chain and hook makers.
„ glass makers.
„ hand makers.
„ jewel makers.
„ jewel-hole makers.
„ cap and arbor makers.
„ cock makers.
„ hand makers.
„ dial finishers.
„ index makers.
„ key makers.
„ lever makers.
„ mainspring makers.
„ material dealers.

Watch movement makers.
„ pallet-wheel makers.
„ pendant makers.
„ pillar makers.
„ pinion makers.
„ roller and lever makers.

Watch secret springer.
„ spring makers.
„ tool makers.
„ verge makers.
„ wheel cutters.
„ oil merchants.

"By this extensive subdivision of labour great rapidity of execution is acquired, and thereby the production of small pieces, costing only 1*d.* or 2*d.*, becomes remunerative." The chief difference between Lancashire and London watch-work is that, in the former county, the rough work and material are produced, while in London it is more the putting together and finishing.

Where there are sufficient apprentices or journeymen to warrant it, the establishment of course comes under the supervision of the Workshops Act. Before the passing of that Act, the trade hours were unconscionably long, though it does not appear that the health suffered much injury, except from working in badly ventilated rooms, and, in some exceptional cases, where brass-filing was carried on. Drinking prevails rather extensively amongst the Lancashire watch makers. By the new American system, watches are now made on the "interchangeable" plan, and, as this system spreads, watch making will become more and more a factory occupation. The wages of workmen, when they do come within this category, are, first class 30*s.* to 40*s.*, second class 25*s.* to 28*s.*, while in Lancashire the earnings will average about 30*s.*

The tables of the Registrar-General show that watch makers live to a fair old age. Total deaths 369.

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
...	..	12	31	52	44	44	67	59	60

The following are the imports of clocks and watches into the United Kingdom:

	Clocks.		Watches.	
	Number.	Value.	Number.	Value.
		£		£
1867	251,355	..	119,697	
1868	241,246	..	121,277	
1869	330,412	..	129,709	
1870	256,861	258,628	..	372,420
1871	325,667	373,572	..	469,704
1872	373,625	438,110	..	351,150
1873	403,183	425,741	..	407,284
1874	421,098	400,686	..	474,119
1875	518,466	405,150	..	451,061

In 1875 we imported of clocks:

From	Number.	Value.
		£
Germany	5,155	9,669
Holland	123,749	27,452
Belgium	7,974	5,684
France	96,897	254,886
America	285,028	107,029
Other countries	10	76
	420,856	400,712

and of watches:

From	Number.	Value.
		£
Belgium	..	409,652
France	..	37,056
Other countries	..	4,489
		474,119

Our exports in 1875 of clocks and watches, of English manufacture, were:

	£
Belgium	28,330
France	6,374
America	16,656
South Africa	9,479
India	14,315
Australia	33,129
Brazil	4,298
Other countries	30,564

The following statistics I extract from Messrs. Kelly's Watch making Trade Directory, as to the number of watches marked at the Assay Office, Goldsmiths' Hall:

	Gold.	Silver.
1850	16,877	62,076
1860	27,118	91,063
1870	24,881	86,260
1871	25,780	96,543
1872	28,441	103,271
1873	30,894	108,971
1874	31,234	109,814

Gold watch cases stamped at Goldsmiths' Hall, Chester:

	18 Carat.	12 Carat.	9 Carat.
1871	12,549	13	Nil
1872	12,919	Nil	6
1873	12,507	12	Nil

Silver cases:

1871	18,395
1872	28,993
1873	36,423

Silver cases assayed at the Birmingham office:

	Weight.
1860	24,103 oz.
1870	12,512 „
1874	33,673 „

II. GOLDSMITHS, JEWELLERS, AND ELECTROPLATERS constitute a large proportion of our operatives. Under the Census tables they are given as follows:

	Males.	Females.
Goldsmith, silversmith, jeweller ..	19,009	3,022
Plater, plated-ware maker	1,351	103

Of these the jewellery trade absorbs by far the larger part, and that it is to a considerable extent an occupation of the young, is shown by the ages:

	5–	10–	15–	20–	25–	35–	45–	55–	65–	75
Males ..	2	962	3192	3159	4945	2857	1959	1192	577	164
Females ..	2	261	982	648	602	234	156	96	33	8

The Factory Returns, however, give us a juster appreciation of the number of workers in plating and jewellery, because they exclude all the goldsmiths and jewellers throughout the kingdom who work only as single masters, like the watch makers. Gold and silversmith's work is the work of an artist, and, as such, scarcely comes under the head of the operative classes, and still less under the factory classes.

	No. of Factories.	No. of Males.	No. of Females.	Total.
Gold and silver work and jewellery	43	1,308	746	2,054
Electroplate	99	4,342	2,282	6,624
Britannia and nickel metal	13	285	79	364

The principal localities for these industries are, London and Birmingham for gold and silver work and jewellery, Birmingham and Sheffield for electroplate, Birmingham for Britannia metal. Mr. Wallis, in his article on Jewellery,* has shown how the jewellers settled down in Clerkenwell, which has been ever since the head-quarters of this trade. In Birmingham the industry assumes a rather different aspect, partly from the increased numbers of those engaged in it, and partly because the great bulk of the cheaper or wholesale jewellery is produced there. Mr. Wright thus speaks of the trade:† "It furnishes a most interesting and important illustration of a peculiarity, which places Birmingham in favourable contrast with every other

* 'British Manufacturing Industries.'

† 'Birmingham and the Midland Hardware District.'

large town and centre of industry in the kingdom, viz. the great number of small but independent manufacturers it supports. There are comparatively few large manufactories, most of the articles for which it is noted being produced in shops where from five to fifty hands are employed. Perhaps nine out of every ten of the master-jewellers, who are now carrying on business on their own account, were originally workmen. In one instance, at least, not less than twelve independent concerns are now in active operation, each employing a number of hands, the principals of these twelve concerns having all been employed as apprentices or workmen in a manufactory, which itself has been established within twenty-five years." Gold and silver chain making has become a very important branch, and over 2000 persons work at it in Birmingham alone, the links of the chains being cut from strips of wire, by machinery, and then soldered, cut, engraved, and polished. In factories for this class of work—which, by the way, employ a good many women and girls—the floors and tables are of iron, as a safeguard against fire, and the risk of losing the gold-dust, &c., for the precious metal sticks to the clothes, and is found amidst the sweepings of the workshop in great abundance; indeed, the gloves which gold chasers and others wear, are always burnt after a certain time by the gold refiners, who find it to their account to collect the metal with which they are impregnated. The smaller the links of the chains, the slower the work, and "it is said that the difficulty of making the smaller chains is so great, that the women who make

them cannot work above two hours at a time."* To be a good gold chain maker, a girl must begin young, commencing with "linking," and passing the chains on to the "finisher," who solders them. "Dipping," viz. placing the metal in aqua fortis, brightening or "charging," viz. putting small pieces of metal together to form supports inside a larger one, as in the case of ear-rings, are other branches of employment.

Jewellery is said to be an unhealthy trade; but it is so, merely from crowded workshops and bad ventilation, and not from any inherent nature of the trade. The fact of so much soldering being done requires a large amount of gas, and this undoubtedly renders the atmosphere close and oppressive. A considerable number of young people are employed on gold ornaments, such as ear-rings or lockets, in stamping the blanks or discs in a screw-press, and cutting them (also in a press) to the desired shape. Stamping requires a good deal of practice before it can be performed with impunity, and many have lost a portion of or a whole finger in gaining their experience. In fact, it is looked upon as a kind of badge of a good stamper, to be minus the usual allowance of fingers. Jewellers, as a rule, are well paid, and working jewellers generally occupy a higher social position than other artisans. The young, however, who work in factories, are neither better nor worse than their fellows, open to the same temptations for evil and the same influences for good. A witness before the Children's Employment Commission mentioned a drawback which is not

* Children's Employment Commission. Third Report, 1864.

common to other trades—viz. the constant presence in the streets and the liquor shops of the "fence masters," or people who buy stolen goods, and lie in wait for the journeymen and boys working at jewellers' shops, to get from them stolen gold-dust and metal. Once in their possession, it is impossible to identify it, as the metal can be melted down over a common gas flame.

Electroplating, which within the last thirty years has risen to the dignity of a great industry, holds a middle place between chemical and mechanical occupations. The late Mr. Aitken, in his article on this subject,* has shown us what were the differences between the process of coating wares made of plated copper, and the electro-metallurgical process of coating with silver. As a trade, the operations of cutting the blanks, "raising up" from flat sheet metal by hammering, "spinning," and stamping, with the subsequent artistic occupations of tracing, chasing or "matting," and graving, are common to other industries where metal is the material, and I need not here say anything more about these. The stage of the proceedings in which the gold or silver solution is deposited upon the goods by the action of electrical force, is one of the most instructive examples in all our industrial history of the application of science to art, and the benefit of humanity. Not only are the wares plated in a far more durable and excellent manner, but a harmless process of gilding has been substituted for the baneful effects of the mercurial vapours, consequent on the

* 'British Manufacturing Industries.'

process of gilding with gold amalgamated with quicksilver.

There are still, however, some classes of work in which gilding by the old amalgam process is preferred to electroplating, on account of its supposed superior durability. A paste of gold and quicksilver is applied to the article, and the mercury is then evaporated by heat. But, with few exceptions, water-gilding, as it is termed, is nearly driven out of the field, and with it the risk of being poisoned by mercurial absorption. Women and girls are largely employed as "burnishers," with blunt-pointed steel tools, or as "buffers," for polishing forks and spoons by rouge. When this is done by steam-power turning "bobbins," a great deal of dust is given off. The inhalation of rouge is apt to cause bronchial irritation and a peculiar oppression in the breathing.

While on the subject of polishes, I may allude to the subsidiary manufacture of glass and emery paper, which, though not coming under the head of jewellery, is sufficiently in request with that trade to introduce it here. The glass and emery are pounded in a mill, and were formerly sifted by girls and women in hand sieves, though this is now done by machinery; and during this process, an immense deal of the most irritating dust is set free, and necessarily inhaled, and particularly during the sieving out the first set or "flow," when the powder is finest. This is probably one of the most unhealthy employments that there is. Dr. Richardson,* in his lectures before the

* Unhealthy Trades. 'Journal of the Society of Arts,' 1875.

Society of Arts, specially calls attention to the bad effects of it, saying that it produced the most typical forms of lung disease which he had ever seen. Examination of the lung after death showed the presence of the glass particles throughout the whole of the minute vesicular structure.

The electroplate and Britannia metal establishments at Sheffield are very similar as regards the condition of labour to those of Birmingham, except that perhaps there are not so many workers in small shops as in the latter town, and more of the factory system. This is so far advantageous, that the workers are usually more independent and better off, for a large manufacturer can afford to hold out better than the small members, who from their necessities must sell at any price.

The wages of electroplate makers were (1871) at Sheffield:

Silver smiths ..	35*s.*	Warehouse-women	12*s.*
Metal smiths ..	35*s.*	„ girls	6*s.* to 7*s.*
Stampers ..	36*s.* to 40*s.*	Burnishers, women	12*s.*
Buffers (men) ..	28*s.*	„ girls	2*s.* 6*d.* to 4*s.*

and, according to Mr. Aitken, in 1873, at Birmingham:

Casters of German silver	35*s.* to 40*s.*	Chasers	30*s.* to 50*s.*
Fitters	30*s.* „ 50*s.*	Engravers ..	30*s.* „ 50*s.*
Stampers	35*s.* „ 40*s.*	Embossers ..	35*s.* „ 45*s.*
Polishers	30*s.* „ 35*s.*	Burnishers	15*s.*, 18*s.*, to 20*s.*

In 1876 an ordinary workman in Birmingham earned 35*s.* per week, and a clever hand about 50*s.*; while in some of the special departments the earnings would amount to 70*s.* Sheffield wages are a little lower than those of Birmingham.

The Registrar-General gives the following statement of mortality:

	Total.	5–	10–	15–	20–	25–	35–	45–	55–	65–	75
Gold and silver ware	297	..	..	11	32	57	35	44	34	48	36
Plated ware ..	16	..	..	..	1	3	2	6	2	1	1

Our imports of articles connected with the foreign trades were, in 1875:

PRECIOUS STONES (UNSET).

	Value.
Belgium	£12,162
France	5,568
America	31,341
Other countries	12,668

GOLD ORE.

	Tons.	Value.
		£
Chili	42	7,504
Other countries	24	2,389

SILVER ORE.

Spain	Quantities not stated.	249,106
America		8,666
Mexico		7,919
New Granada		28,315
Peru		35,753
Bolivia		117,745
Chili		77,145
Other countries		20,795

Our exports of plate, plated and gilt wares, were, for the last six years, of the value of

	£		£
1870	190,757	1873	278,403
1871	192,493	1874	284,440
1872	232,016	1875	304,447

and in 1875:

	Oz.	Value.
		£
Gold plate	25	165
Silver plate	119,060	69,181
Plated and gilt	..	233,936

Our chief customers were France and Belgium for silver plate; Australia, Sweden, and Norway for gilt wares.

CHAPTER VII.

PAPER AND BOOKS.

I. Paper Making.

The workers in paper form a large and important body of English operatives, looking at the trade *directly;* leading on *indirectly* to the sister occupations of printing, bookbinding, publishing, newspaper work, &c., the trade assumes very extensive proportions, and probably gives employment to no less than 130,000 persons. In the manufacture of paper, with which alone I shall deal at present, the numbers are as follows for England and Wales, according to the Census Returns:

	Males.	Under 20.	Above 20.	Females.	Under 20.	Above 20.
Rag gatherers ..	2,312	220	2,092	1,449	297	1,132
Paper makers ..	10,142	2,692	7,450	6,630	2,337	4,293

The list of rag gatherers and collectors alone is rather formidable, and show how many people gain their livelihood in connection with the dust-heap, which is the lowest stratum, upon which is mainly founded the paper trade. The cinder sifter and dust collector is a genus *per se*, although we have no analogous trade to that of the Paris *chiffonier*. The occupation, although full of dust and unsavoury smells, is not an unhealthy

one, as was shown by Mr. Jardine Murray, who, in 1859, instituted a series of inquiries* into the health of those who work amongst rags, and the dubious gatherings of bones and bottles which are to be found in the slums and purlieus of our great towns. He expected to find the evil results of contagion from the decay of filthy animal matter, and from the swallowing of dust; but, instead of this, he found that epidemic or contagious disorders from this source were practically unknown, and that all that the workers did suffer from, was shortness of breath, and a tendency to bronchial affections. One rag and bone collector who had been in business for thirty years, always employed ten hands, and collected 250 tons of rags per annum, said, that there had only been one death amongst his workpeople for ten years.

In 1871, according to the Factory Returns, the statistics of paper mills were as follows:

	No.	No. of Machines.	Moving Power, Steam.	Moving Power, Water.
England and Wales	271	352	20,746	5,473
Scotland	53	77	5,957	2,187
Ireland	20	27	245	652

and of people employed:

	Under 13.	Males up to 18.	Above 18.	Females.	Total.
England and Wales	227	2,055	8,463	9,295	20,040
Scotland	21	574	2,729	3,653	6,977
Ireland	..	100	458	475	1,033

'Journal of Public Health.'

In England the most favourite counties for paper making are, Bucks (21), Devon (18), Durham (10), Hertford (11), Kent (29), Lancaster (42), and York (28); in Scotland, Edinburgh (17), and Lanark (7); in Ireland, Dublin (13).

Messrs. Kelly, in their 'Paper Trade Directory,' estimate the present number of paper mills at 350, with 500 machines, while the quantity of paper made annually must exceed 300,000,000 lb. in weight, or nearly double the make of twenty years ago.

The exact ages of the English workers were, according to the Census:

	5–	10–	15–	20–	25–	35–	45–	55–	65–	75
Males ..	11	1006	1675	1336	2261	1619	1107	649	347	131
Females ..	11	538	1788	1357	1197	851	514	245	114	15

which shows a considerable proportion of juvenile labour.

Professor Archer, in his article on Paper,* has told us how completely the art of paper making has become a mechanical one, all the operations, after the raw material, be it rags, Esparto, or any other fibre, is once made ready, being conducted to a termination by one unbroken stream of machinery. It is in the early stages that we find the chief employment of the young, the bulk of them being occupied in the rag and glazing rooms. For the cutting and sorting rags or cotton waste, women and girls stand at long tables, each with a well of rags and a space to herself, the latter being

* 'British Manufacturing Industries.'

hollowed and covered with wire, so as to allow the dust to fall through. There is also a strong curved knife, fixed upright on the table, with the edge turned away from the worker, who leans forward and draws the rag across the knife. This cutting and sorting is the most unhealthy part of the whole proceeding, for the air is full of dust. According to the rag-collectors' statistics, there is nothing prejudicial in the rag-dust; but, in this case, the dust is concentrated and continuous, and does undoubtedly affect many of the workers with symptoms similar to hay fever, and especially when the rooms are crowded and badly ventilated. Sometimes the rags, and particularly where bagging and old ropes are used, are cut by machinery, being put into a cage fitted with spikes, and having a "chopper" or open wheel armed with knives, and revolving at the mouth of a feeder. The making of paper by hand is but seldom practised now in this country, except by a few makers who have a speciality for best writing and drawing paper, the hand-made in these cases being considered to be superior to the machine-made. The various operations consist of boiling, washing and beating, and bleaching, after which, the pulp is passed on to the paper-mill proper, where it is couched, pressed, calendered, water-marked, and cut. When Esparto grass is used, the treatment is somewhat different, the bales being first of all carefully picked over by women and girls, who remove all pieces of root and extraneous grasses. Children are employed to receive the sheets as they fall from the cutting machine, and also in the glazing room (usually known as the "sol"), taking the piles of

paper, called "wads," to the glazing rollers. In the manufacture of mill-boards, too, boys are occupied in taking off the damp boards from the reel at each revolution. The bleaching is usually done by chloride of lime; but in Lancashire the material is (or was till very lately) "gas-bleached" by chlorine, which produces unpleasant feelings in those exposed to it. In the large, modern mills—such as, for example, that of Messrs. Joynson, at St. Mary Cray, in Kent—all known improvements are adopted for the benefit of the work-people. The dust is reduced to a minimum, by the rags being treated in a machine before being given to the women to sort. Where paper is made by hand, there is generally a gang of three to each vat, consisting of (*a*) the vatman, who dips his frame or mould into the pulp in the vat, and passes it on to (*b*) the "coucher," who takes the mould and turns the sheet on to a "felt" or blanket, while (*c*) the "layer," generally an apprentice, takes the sheets from the pile of felts or "post," and places each one smoothly on a desk called the "lay stool." In this he is often helped, and particularly when the sheets are very thin, by the "slice drawer," a lad with a thin strip of felt-covered wood, with which he prevents the sheets from sticking, until the top and sides have been laid square. The departments of a paper mill in which women work are principally, as we have seen, the rag sorting, cutting, and the glazing. Others are employed at the "rolls," generally two at each roll, one to feed and one to take out, while a third called the "jogger" carries the sheets away. In the

"sizing room," too, they have to lay the sheets on to the endless felt, for the purpose of being carried through the sizing trough.

Taking it altogether, the paper trade may be said to be as healthy as any other, one thing in its favour being, that nearly all paper mills are situated in the open country. The banks of rivers are usually sought after for this purpose, such as the Medway, the Cray, and the Darenth in Kent, the Colne in Bucks, &c.; and there is no doubt, but that this feature of the trade obviates a good many of the evils of town factory life. The engine and the sizing rooms are at a considerable temperature—the latter often from 80° to 90°, and at times even more—as it is difficult to admit cold air into it, without causing coagulation of the size. The tables of the Registrar-General show the following mortality:

	5–	10–	15–	20–	25–	35–	45–	55–	65–	75
Rag pickers ..	..	2	3	2	8	11	15	22	16	15
Paper makers ..	..	4	7	11	17	30	21	15	23	24

The paper-making trade comes under the Factory Extension Act of 1867, and is included under the modifications of that Act, which permits "male young persons to be employed during the night, subject to the same intervals of rest which they are allowed during the day, and subject to the provision, that no male young person employed during the night shall be employed during either the preceding or succeeding

day." Night-work, however, is not required to a large extent. Mr. Redgrave stated, before the Factory Inquiry Commission of 1875, that the number of young persons (from thirteen to eighteen) employed in Leeds, Newcastle, Rochdale, Edinburgh, Glasgow, and Dundee, were 1428, and those at night only 162; in Kent and Surrey, 120 young persons, and 51 at night; 235 in Herts, and only 12 at night. I extract the following table of wages from the Factory Returns of 1871:

Skilled workmen	20*s.* to 26*s.*
Pan-men	18*s.*
Bleachers	18*s.*
Rag sorters	10*s.*
Paper sorters	10*s.*
Washers off	18*s.*
Machine men	24*s.*
„ boys	12*s.*
Rag engineers	24*s.*
Labourers	15*s.* to 19*s.*
Women	7*s.* „ 13*s.*
Young persons	4*s.* „ 14*s.*
Children	2*s.* „ 4*s.*

The following are the imports of printing and writing paper, principally from Belgium and Sweden:

	Cwt.	Value.
		£
1867	174,429	389,156
1868	177,220	382,294
1869	168,975	375,104
1870	173,616	445,613
1871	157,283	407,480
1872	203,742	578,833
1873	195,336	593,552
1874	192,200	509,822
1875	188,027	442,871

Imports of materials for paper making:

	Linen and Cotton Rags.	Esparto and Vegetable Fibre.	Value.
	tons.	tons.	£
1867	18,407	55,074	559,351
1868	17,860	95,880	809,248
1869	16,980	87,418	726,410
1870	22,394	110,389	1,202,137
1871	26,757	143,313	1,680,771
1872	22,309	104,588	1,176,435
1873	16,151	102,751	1,128,814
1874	17,209	119,188	1,265,276
1875	15,879	141,319	1,384,397

The rapid growth of the Esparto trade will here be noticed, together with the decline in that of rags. On the other hand, we export a certain quantity of rags (except woollen), and other paper materials.

	Tons.	Value.
		£
1870	23,993	389,909
1871	33,060	588,836
1872	30,546	578,019
1873	16,800	297,864
1874	20,215	302,332
1875	24,400	326,778

and of paper (except hangings and papier mâché):

	Cwt.	Value.
		£
1865	145,262	
1870	177,683	530,646
1871	228,894	668,926
1872	305,092	878,592
1873	319,884	973,617
1874	281,761	874,114
1875	320,165	941,243

In 1875 the particulars of the imports were:

	Tons.	Principal Sources.
Linen and cotton rags	15,792	France and Germany.
Esparto, &c.	141,900	Spain and Algeria.
Pulp of rags and wood	11,280	Sweden and Norway.
Woollen rags	25,415	France and Belgium.

and those of paper:

	Cwt.	Principal Sources.
Printing or writing ..	187,964	Belgium and Sweden.
Hangings	9,797	France.
Brown and waste ..	..	„
Mill and pasteboard ..	286,529	Germany and Holland.

Our exports of paper in the same year:

	Cwt.	Principal Customers.
Printing and envelopes	212,430	Australia and Bengal.
Hangings	64,434	„ „
Mill and pasteboard ..	13,258	„ „
Unenumerated (except papier mâché) ..	93,207	„ „

The consumption of paper in England must be very enormous, when we consider that in 1875 there were 1624 newspapers published, of which 136 were dailies, a considerable increase from thirty years ago, when the dailies only numbered 14. The magazines, including the quarterlies, numbered 657. The Post-office returns coincide with this extraordinary activity. In 1865 the average annual number of letters was

373,000,000, which had increased in 1874 to 967,000,000. The post-cards numbered 79,000,000, the newspapers and book-packets 259,000,000.*

In the year 1875, the number of letters was 1,008,392,100; of post-cards, 87,116,300; of newspapers, 279,716,000.

II. Printers.

The paper trade naturally leads to the printers, for whose behoof it is mainly that paper is made. The Census Returns give an aggregate of 44,073 printers in England and Wales, with 741 females; so that it is clearly not a trade at present which employs to any great extent the labour of women, although there is no reason why it should not become so more than it is. The ages of the males were:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
7	3,678	10,771	7,318	10,024	5,788	3,733	1,774	801	179

Of the whole total of 44,000, London absorbed in 1871 upwards of 20,000; but there is a growing tendency towards the giving out of printing orders into the country districts, where it can be done at less expense, owing to the comparative cheapness of rent and country labour. Railway facilities are now so excellent, that but little inconvenience is experienced from delay, and I have no doubt that in time we shall find the printing trade largely increased in other than

* Kelly's 'Paper Trade Directory.'

town neighbourhoods. The Factory Returns agree very much with those of the Census, except in the matter of females. Although there are in the provinces a good many little jobbing printers, who do most of the work themselves, and who would not figure in the returns, the greater number of printing establishments throughout the country are workshops or factories in the eye of the law, and consequently under supervision.

	No. of Printing Works.	No. of Cylinder Machines.	No. of Cylinders.	No. of Platen Machines.	No. of Hand-Presses.
England ..	3,256	3,519	4,052	585	8,562
Scotland ..	255	418	520	107	948
Ireland	229	270	341	40	775

NUMBER OF EMPLOYÉS.

	Under 13.	Males up to 18.	Males above 18.	Females.	Total.
England ..	309	13,547	25,502	2,667	42,025
Scotland ..	56	1,743	3,588	873	6,260
Ireland	9	1,242	2,455	418	4,124

We may consider, in round numbers, that there are now 60,000 employed in printing. In no trade has mechanical ingenuity been more rife than in this, and in many of the large establishments and our leading newspaper offices, marvellous and intricate machines are now found, which may almost be called automatic, so little attention and supervision do they require.

Putting aside these specialities, such as the Walter, Marinoni, Hoe, and other machines of this class, we find that even in ordinary printing work, there has been an enormous advance in the character of the machines. The Maine, Wharfedale, Standard, Horizontal, Minerva, Atlas, S. Cropper, Prestonian, Graphic, Victory, Diamond, Universal, &c, are all well-known types of ever-active improvement going on in this department of labour; although, as Mr. Hatton tells us,* "a certain class of printing was, and still is, confined to the hand presses, known as the Stanhope, Albion, and the Columbian. In deference to a regulation of the trade union, a given quantity of hand-press work must be done in strict union offices, though every year brings its new inventions for superseding the hand press." Powerful and domineering as the trades unions are, they will not be sufficiently powerful to stem the progress of invention, or to prevent new machines coming into universal use.

The two principles now at work throughout the kingdom are those of the "platen" and the "cylinder"; in the former, the type being fixed on a table under a heavy press called the "platen," which moves vertically, so that the sheet, which is laid on a skeleton frame, is pressed on to the type by the platen; it is then taken off and replaced by another. In the cylinder, a boy lays the sheet on a table, so as to allow it to be caught by the arms or grippers of the cylinder, as it revolves. It is then carried round to meet the type at the lowest point of revolution, and each sheet,

* 'British Manufacturing Industries.'

when printed, is taken off by another boy, who sits watching at a certain point for it.

The conditions of labour in printing offices vary much, and may be said to correspond with the various degrees of improvement in machinery. Many of our first-class printers have premises which are models of neatness, convenience, and sanitary arrangements; but it is to be feared that the great bulk are still the very opposite of these, and that there is no material alteration since 1862, when Mr. Lord stated in his Report to the Children's Employment Commission, "The general state of printing offices in London is certainly very bad. Not only are the composing rooms generally over-crowded and ill-ventilated, and the reading closets almost stifling, but even machine rooms are often extremely dirty, close, and unhealthy. One witness spoke of a machine room in London, where the roof was so low, that a hole was cut in the ceiling for the head of the boy, who was 'laying-on,' to go through." There is nothing in the operation of printing actually of an unhealthy nature; but one cannot look at printers, especially in our large cities, without being struck with their pallid faces and jaded appearance. Even the lads, who may be seen any day about dinner time playing in the neighbourhood of the great printing offices around Fetter Lane and elsewhere, have the same unhealthy countenances, eminently suggestive of want of air and sufficient sleep. Since the Factory Extension Act of 1867, under which letter-press printing is placed, there is undoubtedly a vast improvement in this; but the necessities of the

trade are such, that night-work cannot be dispensed with, and all that remained to do was to legislate, so that it might fall as lightly as possible upon the young. So bad and unreasonable was this system of long hours previous to the Act in question, that one establishment, largely concerned in a "monthly" business, had acquired among the operatives the suggestive title of "The Slaughter-house," where, for four or five nights every month, not one person got more than an hour's sleep, whatever their age. In several respects, the printer's is doubtless a very peculiar trade, and more particularly in the sudden rushes and pressures of business, to which every office in a large way of business is subject. The printing of daily newspapers, of course, involves night-work; but it is regular and always the same. "The causes which give rise to the over-work, and the seasons in which it occurs, are very various. In the general run of printing houses, the three months immediately preceding Christmas are those of the greatest pressure. The printing of magazines, railway guides, and other monthly periodicals, results in a pressure for several days at the end of the month. Houses which have Parliamentary printing are severely pressed during the session. There is also the irregular and uncertain pressure of law-printing, or of circulars, pamphlets, and other job-printing. That which operates with the most regular severity in the direction of long hours, is perhaps the printing and publishing of weekly journals, especially when two or three of such papers are printed at the same office."

However much the adults may be worked overtime, the young are now better protected than they were; the modifications of the Act allowing boys of thirteen to be employed in day and night shifts, viz. one week all night and the next week all day. Lads of sixteen may be employed between 6 and 9 A.M., or between 1 A.M. on Monday and 11 P.M. on Saturday, provided that they do not work more than 11½ hours on any one day, and that they have a day's interval between each day of employment.

It is to be feared that authors and editors, too, are not blameless in contributing to the long hours, as some of the former appear to imagine that their "copy" must appear in "proof" within a fabulous shortness of time; while editors, on the other hand, often labour under the impression, that everything may be put off to the last moment.

The two principal classes of workers in a printing office may be divided into compositors, viz. those who "compose," or set up the matter to be printed, and those who officiate at the machines. How far the future of compositors may be affected by the invention of composing machines, it is impossible to say; for at present it is little more than an experiment. Compositors form the bulk of printers, their duty being to stand at "case" and set up the "form," or as many pages of type as the sheet when printed will fold into. When the form is out of the compositor's hands, it has to undergo a certain amount of preparation by the machine-minder before it is actually ready for the press, a plain form, as in

ordinary book-printing, taking from two to four hours to prepare; while ornamental printing and woodcuts take much longer. Boys are employed at the machine, usually two or four to each, according as it is a single or a double one; one laying on the sheet ready to be printed, the other taking it off after it is printed. They also gather up the printed sheets, and put ink on the type for the press-man. In the composing room they work at "case," which is a wooden box divided into compartments, from which they select the type to fill the "stick"; they are also employed as "readers." With lithographic printers, the chief work for them consists in damping the stone or turning the handles of the press. Women have of late years found an opening in printing offices, chiefly in composing; and the credit of demonstrating their capabilities for doing so is principally due to Miss Emily Faithfull, who, in 1859, started (first of all in Great Coram Street), and for many years conducted, the "Victoria Press," in which the bulk of employés (though not the machine hands) were women. In Glasgow and Edinburgh, however, the movement has prospered to a much greater extent, for a considerable number of women are employed in these cities as compositors, and there certainly appears no earthly reason why they should not succeed in this branch of work as well as men, while in many ways, such as cleanliness and habits of steadiness, they are far superior. Correcting for the press, indeed, is an employment which may be pursued by cultivated women with great advantage. In 1874, female compositors could earn from 10*s.* to 30*s.* a

week, and a good reader could make 42*s*. The ordinary rates of wages in London were (1871): compositors, 40*s*.; press-men, 34*s*.; machine-men, 40*s*.; boys, 6*s*.; and in the provinces, for jobbing printing, 24*s*. to 30*s*., according to locality; for weekly newspapers, 25*s*. to 31*s*. In 1876 the average earnings of good printers on high-class work were 45*s*. per week, some getting as much as 60*s*.; of printers on commercial work, 30*s*.; for common printing, however, indifferent hands could be had for 25*s*. The ordinary rates may be taken as, for press-men, 25*s*. to 32*s*.; for compositors, 27*s*.

The Registrar-General says of the trade, that "publishers and booksellers fare well in health and life; they are generally masters in better circumstances than their confederates, bookbinders and printers, including masters and men, who often work in badly-ventilated rooms, and die at a rate of mortality exceeding the average." The deaths (1871) were 646; below 20, 61; above, 585.

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
..	4	57	92	114	91	98	88	63	39

There is no doubt, but that the lives of those who have to work in large, well-arranged houses, such as are now to be found in London and our large cities, are of longer duration than those in the ordinary printing offices.

The following are the statistics of exports of printed books:

	Cwt.	Value.
		£
1867	49,814	610,538
1868	61,408	684,243
1869	59,180	675,041
1870	54,190	630,855
1871	62,210	719,042
1872	81,510	883,149
1873	84,001	913,846.
1874	83,353	904,792
1875	35,734	915,098

In 1875 our imports, mainly from France, Germany, and Holland, were 14,610 cwt., value 166,188*l.*; and our exports 85,777 cwt., value 916,851*l.*, principally to Australia and the United States.

The number of books issued in 1875, according to the 'Publishers' Circular,' including new books, new editions, and American importations, was 5218. Of these, 316 came under the latter head.

III. Bookbinders.

The trade of bookbinding differs from the preceding in one very important particular, the employment of female labour, which is carried on to a large extent. In 1871 there were in England and Wales:

	Total.	Under 20.	Above 20.
Males	7,917	1,096	6,205
Females	7,557	3,270	4,287

of the respective ages:

	5–	10–	15–	20–	25–	35–	45–	55–	65–	75
Males ..	..	344	1581	1319	1815	1204	854	494	257	49
Females ..	4	660	2606	1660	1187	643	449	233	92	23

The number working in factories or workshops (according to the Act) was:

	No. of Factories.	Children under 13.	Males up to 18.	Males above 18.	Females.	Total.
England ..	667	60	1,852	4,295	5,321	11,528
Scotland ..	59	6	308	812	1,387	2,513
Ireland ..	59	1	144	289	574	1,008

Of the bookbinding establishments, Middlesex, i. e. London, absorbs one-half.

"Girls and women are employed in the following branches of the bookbinding trade:—Folding, sewing, collating (placing the sheets in alphabetical order), arranging the plates, laying-on gold on covers, head-banding, covering magazines, &c. The number of folders and sewers far exceeds that of the workers in any other branch. In laying on the gold, and in covering magazines, men were formerly exclusively employed, and the introduction of women is a recent innovation. Girls are usually apprenticed to the trade at fourteen years of age for two years, but without formal indentures; and they are paid a small amount during apprenticeship. The earnings by piecework and time-work in all branches vary from 7*s.* to 25*s.* per week, but the average may be taken at 11*s.* a week.

The usual price for folding is a penny for 100 sheets, but in some shops only three farthings per 100 is paid. Great quickness of hand is required in folding and sewing. In collating, considerable care and intelligence are necessary, and the worker is fined for the smallest error. Care and economy must be exercised in laying on the gold leaf. Head-banding is a branch of the work not much in demand now, excepting for expensive bibles, or for some other books in the most costly kind of binding."* The boys are employed at rolling presses, pasting cloth on to the mill-boards which form the sides of bound books, or hammering the backs of the sheets into a convex form after they have been sewn and glued. Folding, especially in the case of newspapers, serials, and pamphlets, is often performed by a series of tables or shelves, each fitted with a folding-knife, and this is speedier than when the work is done by hand. An immense deal of folding, however, is given out to be done at the workers' houses, particularly in times of pressure, and herein lies a great evil, which amounts to an evasion of the Factory Act: for, the legal hours of work being completed, it is neither right nor fair that the women should be asked to take any additional work home, the performance of which necessarily involves sitting up late and forfeiting a portion of the night's rest. It is true that it is considered a voluntary act on the part of the workers, but they well know that to refuse, would be tantamount to an early dismissal on the first pretext that could be found. The same causes produce pressure of work in bookbinding and folding as in printing, viz. the

* The 'Labour News.'

issue of the serials at the end of the month. This is particularly the case towards Christmas, when so many hands are required for the gift and other books appertaining to the season. As regards sanitary conditions, some of the bookbinders' premises are airy and well ventilated, and others just the reverse; and there are a good many small "garret masters" in the trade, where perhaps these necessaries are at the minimum. In the work itself, there is very little that is unhealthy, except the use of the gas-stoves where the tools are heated, and which doubtless render the atmosphere close and oppressive. This is particularly the case in branches of the trade like leather-binding, but it is not so bad in the ordinary blocking presses. That part of the workrooms, too, where gold leaf is laid on the covers, is not so well ventilated as others, because any draught would throw the leaf about and spoil it. The folders sometimes find, that the perpetual rubbing of the finger and thumb upon the paper makes them bleed, though it is not a very serious inconvenience, and disappears after a little practice. The sewers really appear to suffer most in health, for the peculiar sideway position in which they are compelled to sit, with one arm at a higher level than the other, is decidedly provocative of chest disease. In the provinces, and particularly at Manchester, a great many young girls are employed in the book trade, and, previous to the passing of the Act, overtime and very long hours were usually the rule, so that when the first of the month fell on the Monday, it was a common thing for the workers to be employed all through Sunday. This is not possible now under the Factory Act of 1867, which

limits the over-work of young persons of fourteen and more to 10 P.M., and that only for ninety-six days in the year. I have already mentioned the average earnings of females employed in bookbinding. The following is a table of weekly wages for the metropolis:

	1871.		1876.	
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Finishers (for leather work only)	40 0			
Forwarder (1st class) ..	36 0	(extra)	36 0	
„ (2nd „) ..	32 0			
Blocker (1st class)	32 0	.. .	32 0	
„ (2nd „)	30 0	..	26 0	
Folders (piecework) ..	12 0	to 20 0	12 0	to 20 0
Sewers	10 0	„ 16 0	10 0	„ 12 0
Collators	11 0	„ 14 0	11 0	„ 14 0
Cloth case makers	..	..	30 0	

The "forwarders" are those who prepare the book to receive the case.

In 1876 the average earnings of the men were 30*s.* to 32*s.*, and of girls, 10*s.* to 12*s.*, though many of the latter got 20*s.* Piecework is the rule.

The only commercial statistic which is of interest in the bookbinding trade, is the importation of gold leaf, which was, in 1875:

From	Number.	Value.
		£
Belgium	34,637,080	65,481
France	6,486,500	12,903
Other countries	973,000	2,013
Total	35,689,986	66,306

IV. Stationers.

The number of stationers throughout England was, in 1871, 7885, of whom 1685 were under, and 6200 above twenty years. The ages were:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
..	311	1374	1134	1934	1343	918	557	258	56

A very large proportion of these consists of persons selling stationery, who have little or nothing to do with it as an industry, while the number of wholesale stationers who make for the trade is comparatively small. It is, however, a trade which is frequently merged into others—the stationer being generally also a printer or a bookbinder, an envelope maker, a machine ruler, a lithographer, a copper-plate printer, or perhaps combining all these occupations. The two branches which give most employment to operatives, and especially the young, are machine ruling and envelope making. Machine ruling is simple work, "consisting of a table covered with a moveable felt, and having across it at its centre an upright framework of wood and strings, to which a cloth pad and grooved pens are attached. In some places boys, at others, young women and girls, are employed at ruling machines; three work at each machine, the elder one, often an adult, turning a handle to move the felt, which carries the sheets under the grooved ruling pens, and also, from time to time supplying ink by means of a

brush to the cloth pad which feeds the pens; the second girl or boy at one end of the machine lays the sheets one by one in succession upon the felt, and the third takes them off at the other end and places them separately on shelves to dry." * Beyond the fact that the labour is somewhat continuous and tiring, as the worker's arms have to be moved rather fast, there is nothing special to detain us; and I will therefore pass on to the envelope trade, which has perhaps been the medium, more than any other, by which machinery of a very ingenious character has been given to the world. The envelope makers are almost entirely females, and are only mentioned as such in the Census tables, which give 1477 as the number employed, viz.:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
..	3	105	622	354	267	100	18	7	1

Several kinds of envelope making machines are now employed by the wholesale stationers, most of which have been familiar to the public at the various International Exhibitions. Where they are in use, they may be almost said to be automatic, to such an amount do they save labour. In some places, an envelope folding machine is worked by hand, consisting of a "plunger," covered with a cloth damped at the edges and attached to arms, which rise and fall by means of a treadle worked with the foot. The

* Children's Employment Commissioners' Fifth Report, 1866.

plunger gives a crease and a bend to the part, so that all that the girl has to do is to flatten it. Others are worked by steam power, and draw the flat envelope into the centre, where two metal fingers place it under the plunger. Envelopes are stamped and gummed also by the same process. A great number of girls are employed as "gummers," folders, and "banders," in the first of which operations a packet of envelopes, with open lips, is placed under a regularly trickling gum-tap, and then spread out to dry. A girl who is experienced in the work can do 100,000 a week, and her earnings would be from 10*s.* to 14*s.* Young girls learning are only paid 2*s.* 6*d.* per week. Mr. Lord mentions in his Report,* that most of the machine envelope girls had acquired a curious habit of "bobbing" forward, in strict time with the machine. It looked very awkward, but no permanent mischief appeared to spring from it. Hand folders, however, suffer from consumption, owing, it is said, to the continual stooping and pressure on the chest. But, on the whole, the employment is clean, not too heavy, and fairly well paid.

The average wages in 1871 were:

Cutters (men)	25*s.* to 38*s.*
Cementers (women)	10*s.* „ 20*s.*
Stampers (plain)..	7*s.* 6*d.* „ 15*s.*
„ (coloured)	12*s.* „ 28*s.*
Folders	7*s.* 6*d.* „ 22*s.*
Machine hands	5*s.* „ 15*s.*
Black borderers	5*s.* „ 30*s.*

* Children's Employment Commissioners' Fifth Report, 1866.

The value of our stationery exports was:

	£		£
1867	374,164	1872	660,662
1868	416,525	1873	673,920
1869	496,752	1874	686,056
1870	489,250	1875	684,208
1871	531,644		

our chief customers being Australia, United States, and Germany.

V. Paper Stainers.

The number of persons engaged in this branch of the paper trade was (1871), males, 1311; females, 448; under 20 years, 636; above 20 years, 1123; and the occupation consists in printing a pattern in colours upon sheets of paper, either by hand blocks, or rollers worked by steam power. The factories are:

	No. of Factories.	No. of Cylinder Machines.	No. of Cylinders.	No. of Hand-block Tables.
England ..	31	77	161	310
Scotland ..	6	8	8	81

employing:

	Children under 13.	Males up to 18.	Males above 18.	Females.	Total.
England ..	217	597	1024	206	2044
Scotland ..	10	76	171	150	407

and there are also in London ten factories where paper colouring and marbling are carried on, employing 250 operatives.

London and Lancashire are the two great seats of this trade, the former being the centre of the block or hand printing, and the latter (Manchester and Blackburn) of the machine printing. This arises, doubtless, from the great prevalence of the calico printing in that county, which is so analogous to the paper staining. The various stages of the operations are: 1st, grounding the paper in an uniform tint with large, soft brushes, the paper being then dried in a steam heated room. A polish or "face" is given by the friction of hand brushes worked by machinery, French chalk or China clay being scattered over it, to facilitate the rapid movement of the brushes. This forms one of the most unhealthy parts of the trade, for not only is a great amount of dust raised, but it is the dust of colouring matter, which is often specially unwholesome. When the printing is done by hand, a workman and one or two boys are employed, the materials being a table with a pad or cushion upon it, and a trough filled with a nearly fluid substance, the surface of which is in contact with a covering of oiled tick or cloth. Upon the upper surface of the latter is placed a square sieve, on which the colour to be used is spread or "teered" by one of the boys, while the other draws the printed paper from off the pad, and lifts it to dry on moveable rods hanging from the roof. When the paper is machine-made, the operations are carried on by adults, the boys or girls, as the case may be,

helping to lay down the paper in lengths, rolling it up, or watching to see that the paper passes smoothly while it is under the rollers.

When paper is marbled, no "teering" is required, and the boys and girls then assist only to fill up the clouded colours, when the "marbler" has done the veining. When it is "flocked," the paper, while moist, is agitated in a drum, having previously had scattered over it the flock powder, which is composed of finely powdered cloth coloured with a vegetable dye. The boy who has to beat the drum, so as to keep the powder in motion, is generally himself coated rather thickly with the dust. A much larger number of girls are employed in Lancashire than in London, and their chief occupation consists in rolling up and cutting off the paper at certain marked points. In any case, juvenile labour is indispensable to the paper stainer, whether the work is done by hand or by machine. Except for the dirt and dust, and, in particular cases, where deleterious colours, such as emerald green, which contains arsenic, are used, the trade is not a bad one, as, from the nature of the work, plenty of air, space, and light are generally required in the workshops of the paper stainers. Like many others of this class of trade, it is busy by fits and starts, work being generally slack in the summer and brisk during the winter, between October and April. A curious fact, incidental to the occupation, is mentioned as to the loss in waste of paper, which one firm in Lancashire stated amounted to about 62*l.* a week, after allowing for the price of the waste, which was sold for 5½*d.* per pound.

The wages are as follows:

Water-colour printers	20*s.* to 25*s.*
Flock printers	30*s.* „ 33*s.*
Metal printers	30*s.* „ 33*s.*
Teerers	5*s.*
Boys employed as winders-up, plaiters-down, cutters-off, &c.	5*s.*

The exports of paperhangings in 1874 were 66,632 cwt., valued at 188,664*l.*; the bulk of which was taken by Australia and British North America.

VI. Paper-box Makers.

I must not quit the subject of paper trades without a brief allusion to this branch of it, for the manufacture of paper-boxes and bags gives employment to a considerable number of girls and young women, although it is to be feared that the spread of machinery may be the means of depriving some of them of their occupation. In 1871 the number of females under this heading was 2127, of the following ages:

5–	10–	15–	20–	25–	35–	45–	55–	65–	75
8	400	754	400	309	129	72	34	18	3

by which it will be seen that the majority are girls barely out of their teens. When the boxes are made by hand, the work is simple enough, consisting mainly in glueing and pasting paper in slips or sheets on to the cardboard. Boys are employed in giving a "half-cut" to the cardboard, so as to make it bend up, by means of a knife sliding in a groove. Paper-bags are usually cut by machinery, the paper, as it is unwound

from the reel, being passed under circular knives, which divide it into strips. "These are re-wound on separate rollers on the other side of the knives, and are placed, as they are wanted, in machines, which, as the paper is a second time unwound, turn the sides over, paste them, fold them together, and deliver the bags complete." When bags are pasted by hand, the girls earn only from 2*s.* 6*d.* to 4*s.* per week, the trade in these cases being very much in the hands of "little" printers. A "seamless" paper-box machine has just been invented (1876), which threatens to revolutionize this trade. By it, the boxes are rolled direct from pulp, which is a great economy, as against the cutting them from cardboard. The saving of labour, too, is calculated at 50 per cent., while at least 600 boxes can be turned out per hour, no matter what size. Probably one effect of this machinery will be to largely extend the trade, and aggregate it, away from home work and the small masters, where it is now principally carried on, into factories; and so far it will be a benefit, for the workshops at present are small, crowded, unduly heated by the gas-lights necessary for the work, and with very little ventilation.

The average earnings of paper-box makers are, for

Paper colourers	12*s.*
Cutters (piecework)	40*s.*
Scorers (boys)	8*s.*
Block and case hands	18*s.*
Plain work	11*s.* to 12*s.*

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ADDENDA.

THE following are the statistics of the yields of coal and minerals for 1875, which were not published at the time that the sheets containing these subjects were in the press.

SUMMARY of the PRODUCE of the IRON MINES in the UNITED KINGDOM in the year 1875.

Counties, &c.	Quantity.		Value.		
	tons	cwt.	£	s.	d.
Cornwall	11,403	15	6,891	9	0
Devonshire	10,595	1	7,983	0	0
Somersetshire	45,165	17	33,186	2	0
Gloucestershire ..	111,825	16	71,760	13	0
Wiltshire	87,152	0	21,688	0	0
Oxfordshire	34,568	0	6,913	12	0
Northamptonshire ..	1,085,898	16	172,812	2	2
Lincolnshire	573,366	0	101,266	0	0
Shropshire	240,568	0	143,419	0	0
Warwickshire	97,456	0	48,720	0	0
Derbyshire	218,132	0	85,835	10	0
Nottinghamshire ..	11,750	0	7,343	0	0
Staffordshire, North	939,023	12	680,791	0	0
,, South	715,451	0	399,820	0	0
Cheshire	1,500	0	750	0	0
Lancashire	834,484	0	625,863	0	0
Cumberland	1,147,968	6	860,976	0	0
Yorkshire, N. Riding	6,121,794	9	1,222,358	7	6
,, W. Riding	353,582	0	159,089	0	0
Northumberland and Durham	60,515	15	37,017	0	0
North Wales	42,184	0	21,092	0	0
South Wales and Monmouthshire ..	495,840	5	247,920	0	0
Scotland	2,452,235	0	920,573	0	0
Ireland	128,602	0	91,331	15	0
Total iron ore production of the United Kingdom	15,821,060	3	5,975,410	0	8

SUMMARY of the PRODUCTION of the COPPER MINES in the UNITED KINGDOM in the year 1875.

Counties, &c.	No. of Mines.	Ore.	Value of Ore.			Copper.			Value of Copper.		
		tons	£	s.	d.	tons	cwt.	qr.	£	s.	d.
ENGLAND—											
Cornwall	67	39,393	204,228	7	9	2,697	19	2	242,115	10	0
Devonshire ..	17	14,097	86,398	7	1	1,006	17	2	20,616	10	0
Cumberland ..	1	142	7,100	0	0	9	18	3	896	7	6
Lancashire.. ..	1	1,373	8,296	3	1	109	17	0	9,886	10	0
Cheshire	1	8,336	6,668	0	0	85	9	3	7,693	17	6
WALES—											
Anglesea	3	4,612	9,224	0	0	126	9	0	11,380	10	0
Cardiganshire ..	1	79	395	10	10	4	18	2	447	15	0
Carnarvonshire..	3	127	635	0	0	8	16	3	727	7	6
Merionethshire..	1	16	80	0	0	1	2	0	99	0	0
Montgomeryshire	1	55	275	0	0	3	18	2	353	5	0
IRELAND	4	3,125	15,625	0	0	255	0	2	22,950	0	0
Regulus precipitate, &c., sold at Ticketings ..	..	173	879	3	0	12	8	3	1,119	7	6
Total of the United Kingdom ..	100	71,528	333,414	11	9	4,322	16	2	388,984	0	0

Average price of copper ore in 1875, £5.
Average price of metallic copper in 1875, £90.

PRODUCE of the TIN MINES and STREAM WORKS of CORNWALL and DEVONSHIRE in the year 1875.

Produce of both Counties.

No. of mines in 1875	184
Produce of tin ore	13,995 tons.
Value of tin ore	735,606*l.*
Produce of metallic tin	9,614 tons.
Value of metallic tin	866,266*l.*
Average price of tin ore	52*l.* 11*s.* 6*d.*
Average price of metallic tin ..	90*l.* 2*s.*

ADDENDA.

SUMMARY of LEAD ORE, LEAD, and SILVER PRODUCE in the Year 1875.

No. of Mines.	Counties.	Lead Ore.	Lead.	Silver.
	ENGLAND.	tons. cwts.	tons. cwts.	ounces.
11	Cornwall	2,566 10	1,932 2	25,681
6	Devonshire	335 4	242 3	4,542
2	Somersetshire	1,546 5	454 18	..
86	Derbyshire	2,283 5	2,090 12	..
9	Shropshire	7,932 5	6,039 0	4,384
21	Cumberland	2,128 4	1,553 17	12,628
17	Yorkshire	4,049 16	2,945 10	7,438
4	Westmoreland	1,646 5	1,106 11	16,114
21	Durham and Northumberland	22,304 4	16,525 7	70,191
	WALES.			
36	Flintshire	3,003 16	2,214 17	12,699
1	Brecknockshire ..	11 0	7 15	..
35	Cardiganshire	5,835 0	4,401 17	46,624
11	Carnarvonshire ..	1,408 3	1,046 4	4,789
1	Radnorshire	68 0	52 10	..
1	Pembrokeshire	80 0	57 10	669
16	Montgomeryshire ..	8,940 10	6,717 17	64,981
4	Merionethshire ..	175 0	135 0	656
7	Denbighshire	2,600 18	1,954 7	10,873
1	Carmarthenshire ..	442 17	332 10	1,327
9	ISLE OF MAN	4,429 0	3,158 10	183,524
1	IRELAND	1,850 8	1,387 18	6,935
4	SCOTLAND	4,109 14	3,078 10	13,303
304	Total of the United Kingdom	77,746 4	57,435 5	489,358
	Total value in 1875 ..	£ 1,202,148	£ 1,290,373	£ 115,747

SUMMARY of PRODUCTION of MISCELLANEOUS MINERALS, &c., in the year 1875.

Miscellaneous Minerals.	Quantity.	Value.
	tons cwts.	£
Zinc ore	23,978 8	75,110
Pyrites, iron	48,035 16	35,136
Arsenic	5,061 5	31,174
Manganese	3,205 11	15,906
Ochre and Umbre	5,315 12	7,185
Wolfram and Tungstate	46 2	382
Plumbago	20 0	*
Fluor spar	358 18	188
Copper and silver precipitate ..	54 7	3,207
	ounces	
Gold	579	2,105

* None sold.

SUMMARY of PIG IRON PRODUCED in 1875.

Counties.	Furnaces.			Production of Pig Iron.
	Works Active.	Built.	In Blast.	
ENGLAND.				tons.
Northumberland	2	4	2	22,870
Durham	16	70	53	786,206
Yorkshire (North Riding) ..	19	85	73	1,240,243
„ (West Riding) ..	13	50	38	267,153
Derbyshire	13	51	38	272,065
Lancashire	9	50	31	558,780
Cumberland	11	51	31¾	486,112
Shropshire	11	26	20	120,996
North Staffordshire	8	39	26	241,398
South „	53	155	76¼	470,450
Northamptonshire	7	18	12	80,689
Lincolnshire	5	21	14	111,683
Gloucestershire	3	10	6	27,088
Wiltshire	1	4	2	32,731
Hampshire	1	1	..	
Somersetshire	1	1	1	
Total	173	636	424	4,718,554

ADDENDA.

SUMMARY of PIG IRON PRODUCED in 1875—*continued.*

Counties.	Furnaces.			Production of Pig Iron.
	Works Active.	Built.	In Blast.	
				tons
NORTH WALES.				
Denbighshire	3	9	6	55,099
Flintshire	1	2	1	
SOUTH WALES.				
Anthracite furnaces	2	13	7	29,889
Bituminous coal districts—				
Glamorganshire	14	78	35	249,667
Monmouthshire	13	62	37	262,253
Total of Wales	33	164	86	596,908
SCOTLAND.				
Ayrshire	7	43	33	358,164
Lanarkshire	13	94	74	631,495
Fifeshire	2	6	2	43,741
Linlithgowshire	2	9	5	
Stirlingshire	2	7	5	16,600
Argyleshire				
Total of Scotland ..	26	159	119	1,050,000
Total of Great Britain	232	959	629	6,365,462

PRODUCTION of TIN, TERNE, and BLACK PLATES in GREAT BRITAIN in the year 1875.

No. of boxes 2,952,116

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Government of Maharashtra
on 18 July, 2018